

September 30, 1957 50 Cents

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

English Electric P.1B
Interceptor Design

•
High Temperature
Avionic Components

Allison Turboprop Test Fleet





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PANAGRA PROVES, PRAISES Goodyear Skid Warning System



In brutal, conclusive tests of new system, skidders stop shorter, safer in this air!

In extensive tests of staggering proportions, Pan American Grace Airways, Inc. has proved the remarkable efficiency of the revolutionary new Skid Warning System* developed by the Goodyear Aviation Products Division.

Equipping Douglas DC-6B's first for altitude tests, and then a DC-7B for greatest high-speed rejected takeoffs and landings at Quito, Ecuador, and on different runway surfaces in La Paz, Bolivia—located at 9,200' and 12,000' above sea level respectively—PANAGRA has made a revealing report of the success of the new Goodyear Skid Warning equipment.

(1) Not a single tire was blown throughout the entire 22 stop run which included landings at speeds up to 150 mph on a loose rock and sand runway surface.

(2) Incredibly short landing distances were achieved through use of this equipment—while landing speeds concentrated were estimated at 125 mph on unpaved surfaces.

As a result, PANAGRA is satisfied it can now receive CAA approval for operating Skid Warning-equipped 70's on fields located where optimum landing is both necessary and extremely difficult.

WRITE FOR INFORMATION on the new system that requires no brake modification, can be easily installed on any existing brake or landing system, allows pilot full control of his landing at all times! Address: Skid Warning, Goodyear, Aviation Products Division, Akron 18, Ohio, or Los Angeles 34, California.

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AVIATION CALENDAR

- Sept. 18-24 5-National Aeronautics Meet-
ing, Aachen, Rheinland, Germany. Section A, Aeronautics Engineering Dept., Society of
Automotive Engineers Hotel Aachen
Gut, Lie, Aachen.
- Sept. 24-28 5-International Conference
on Rocket and Earth Satellite Programs
for its International Geophysical Year.
For invitation write: Division of Informa-
tion, U. S. National Committee, IAGLR,
National Academy of Sciences, 2101
Constitution Ave., N.W., Wash., D. C.
- Oct. 1-8-International Conference on
Lubrication and Wear Institution of
Mechanical Engineers, London, England.
- Oct. 1-13-National Infrared Instrumentation
Symposium, Washington-Sheraton Hotel,
Fairfax, Calif. (By invitation only).
For details write: Arthur J. Lewis,
National executive chairman, Infrared in
Aerospace Symposium, 1510 S. Davis St.,
Pasadena.
- Oct. 2-4-National Airport Conference,
University of Oklahoma, Norman, Okla.
- Oct. 2-4-Tenth Annual Meeting and
Lecture, National Bureau Aircraft Res-
earch, Computer Hotel, Dallas, Texas.
- Oct. 4-6-First Annual Study Group, Soci-
ety of Experimental Light Metals, Beach
Hotel, San Diego.
- Oct. 8-11-International Northwest Airlines
Council, 2nd annual convention, Fairmont
Hotel, Calgary, Alberta, Canada.
- Oct. 13-18-1964 Annual National Electronics
Conference, Hotel Sheraton, Chicago, Ill.
- Oct. 17-9-1964 Annual Electronics Con-
ference, sponsored by American Society
of Lubrication Engineers and American
Society of Mechanical Engineers, Royal
York Hotel, Toronto, Canada.
- Oct. 17-18-International Symposium, Love
Flight Progress, Loveland, Colorado.
- Oct. 17-18-9-1964 Annual Congress, Inter-
national Astronautical Federation, Barce-
lona, Spain. For details write: IAF, 57
Lavelle Rd., Cranford, Mass.
- Oct. 18-19-1964 Annual Airport Development
and Discussion Conference, Delaware
Hotel, Newark, N. J.
(Continued on page 6)



Photo courtesy of North American Aviation Co. Group

HEAT'S ON... and ready to scramble!



The Convair F102A scrambles to intercepting
altitude at a moment's notice... thanks to the
reliable Herman Nelson MC-1 Portable Heater
which supplies precisely controlled quantities of
warm and tempered air for post-flight servicing.

Heat of the MC-1 is this Heat Exchanger unit,
precision fabricated by Lavelle to Herman Nelson
drawings and specifications. Proved under test
to exceed 1,000 hours of continuous operation,
the Heat Exchanger assures dependable heat to
speed take-off when the F102A is on "alert".



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During a five-year period, frequent review of
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AVIATION WEEK • SEPTEMBER 30, 1957

Vol. 43, No. 13

Published weekly (with an additional issue in December) during the aviation season, this magazine is published by the Aviation Week Group, Inc., 1220 Avenue of the Americas, New York 20, N. Y. It is published weekly except during the winter months when it is published bi-weekly. The subscription price is \$3.00 per year in advance. Single copies are 10 cents. The circulation is approximately 100,000. The magazine is published by the Aviation Week Group, Inc., 1220 Avenue of the Americas, New York 20, N. Y. It is published weekly except during the winter months when it is published bi-weekly. The subscription price is \$3.00 per year in advance. Single copies are 10 cents. The circulation is approximately 100,000. The magazine is published by the Aviation Week Group, Inc., 1220 Avenue of the Americas, New York 20, N. Y. It is published weekly except during the winter months when it is published bi-weekly. The subscription price is \$3.00 per year in advance. Single copies are 10 cents. The circulation is approximately 100,000. The magazine is published by the Aviation Week Group, Inc., 1220 Avenue of the Americas, New York 20, N. Y. It is published weekly except during the winter months when it is published bi-weekly. The subscription price is \$3.00 per year in advance. Single copies are 10 cents. The circulation is approximately 100,000.



New VAN TRAILER by Craig houses all this equipment . . . with room to spare!

There's plenty of room inside the new Insulated Cargo Van Trailer LM4651. With its 3,000 pound payload and roomy 575 cubic foot interior, this rugged van trailer can house 10 standard 6-foot racks, fully loaded with electronic equipment — and still allow ample space for operation and maintenance.

Whatever the load — a complete electronic system, test equipment, mobile maintenance shop, or more — you'll have your equipment arrive quickly and safely in the LM-4651. This van trailer was made to meet Government specifications for world-wide, all-weather use.

Quick facts about the LM-4651:

WEIGHT: Approximately 4,000 pounds including fully

PAYLOAD: 3,000 pounds.

DIMENSIONS: (Loaded) 140 inches long, 90 inches wide, 79 inches high.

INSTALLATION: overall standard flat U-

frames 470-50.

FEATURES INCLUDE: aluminum-faced

insulation; steel reinforcement; lighting

systems; power distribution; low profile

entry ports; entry, jacks for leveling; and

a quick detachable utility with coil spring

and tie-down systems; air conditioning; service

hookups for tanks; and single beam towing

eyes.

ACCESSORY EQUIPMENT AVAILABLE: 20

cinch air conditioners; seats; workbenches;

water, cables; spare parts containers; etc.

For further information, write Craig today!

Craig Systems, Inc. Dept. 26-30, Denver, New Tel. 3F49 • 1970

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OTHER CRAIG PRODUCTS . . . transportable and mobile electronic systems, shelters, trailers, vans, and 6-wheel trailers, aircraft carriers, transport containers, mobile towers and much

IS TRANSPORTABLE: By C-119 or larger cargo aircraft.

ELECTRONIC INSTALLATIONS: Craig provides complete layout and installation of equipment including wiring and component placement.



Van Trailer LM-236, front view, with jacks in position.

AVIATION WEEK, September 30, 1957

(Continued from page 5)

- Oct. 9-11—National Fall Convention, Society for Experimental Space Analysis, El Comita Hotel, San Diego, Calif.
- Oct. 10-11—National Space Management Symposium, Sherman Hotel, Chicago, Ill.
- Oct. 10—Constant Speed Drive Development, VEE, Engineers Club, Philadelphia, Pa.
- Oct. 10-11—Conference on Computers in Control, American Institute of Electrical Engineers, Chalmers Hotel, New York, N. Y.
- Oct. 10-11—1957 SAE Canadian Convention, Automobile Building, Exhibition Park, Toronto, Ont., Canada.
- Oct. 17-18—17th Annual Convention, The Magnesian Association, Birminghams Hotel, New York.
- Oct. 20-22—Aviation Flight Society Fourth Annual Western Forum, Hotel Statler, St. Louis, Mo.
- Oct. 21-21—Canadian Aeronautical Institute—Institute of the Aeronautical Sciences Meeting, Montreal, Canada.
- Oct. 21-21—Conference on New Developments in the Field of Power, American Society of Mechanical Engineers, American Hotel, Manhattan, N. Y.
- Oct. 21-25—1957 National Safety Congress, Conrad Hilton Hotel, Chicago.
- Oct. 23—Third World Conference for Air Traffic—Workshop on Air Traffic, Seattle, Wash., U. S. A.
- Oct. 24-25—Fourteenth Annual Display, Aviation and Equipment, Aeronautical Society, Pan Pacific Auditorium, Los Angeles.
- Oct. 24-25—Computer Applications Symposium, Morrison Hotel, Chicago, sponsored by American Research Foundation of Systems Institute of Technology.
- Oct. 24-25—1957 Annual Meeting, American Society of the U. S. Army Signal Corps Hotel, Washington, D. C.
- Oct. 24-24—First National Conference on Applied Meteorology, Hotel Statler, Hotel Statler, New York.
- Oct. 24-26—United East Coast Conference on Instrumental and Navigational Fixtures, Fifth Regiment Army Barracks, New York.
- Oct. 25-31—National Industrial Packaging & Display Exposition—Morrison City Convention Hall, N. Y.
- Oct. 26—National Electrical Equipment Display, U. S. Coast Hotel, San Diego.
- Oct. 27-28—1957 World Meeting, Professional Group on Nuclear Reactors, Hotel Statler, New York.
- Nov. 2—International World Metallurgical Congress & Sixth National Metallurgical & Composite Forum, Hilton Sheraton and International Amphitheatre, Chicago.
- Nov. 4-4—Fourth Institute on Electronics in Management (economic data processing system), The American University, 1901 F St., Washington, D. C.
- Nov. 4-5—1957 Military Industry Guided Missile Reliability Symposium (invited to share with Soviet scientists discussion), Naval Air Station, Fort Curtis Ft. Vliet, Calif.



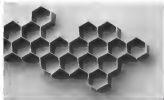
CYCLONE 9 powered SIKORSKY S-58; fly in world's largest ferrying operation

Offshore oil development moves at a rapid pace in the Gulf of Mexico, where Hurricane Oil & Refining Company operates the world's biggest helicopter ferrying operation. Last year, more than 85,000 passenger trips were made from Grande Isle, Louisiana, just carrying employees to the fifteen Humble drilling rigs in the Gulf. Latest additions to Humble's fleet of helicopters are four giant Sikorsky S-58s, powered by specially adapted, advanced models of the Curtiss-Wright Cyclone 9 engine.

The trip from shore to rig used to take four or five hours in a lumbering workboat. Now it's a pleasant half-hour hop. And the same transformations — from time-consuming, drudgery machine travel to quick by-air commutes — is the pattern wherever Cyclone 9-powered "captains are put to work. In military service, in airport-to-city helicopter services, in rough-terrain rescue and supply work, in messenger and delivery service for industry, the modern helicopter has assumed its rightful stature and is steadily increasing its importance in today's transport picture.

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for the
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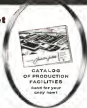
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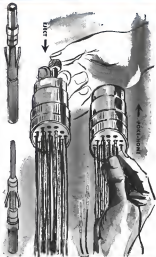
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- ★ Wired outside the connector—"poked home" for assembly
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Chicago 58, Illinois

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with "impossible" accuracy!

Manufacturers of electronic equipment requiring accuracies hitherto impossible are pointing to Western Gear for the gears and units to drive and control their incredibly accurate equipment. Until now, mechanical assemblies have not been able to keep pace with the 100% reliability requirements of this equipment. But Western Gear research, design and manufacturing engineers have combined their talents to develop new methods and techniques for the production of intricate gear assemblies, gear control systems and even complete installations of a wide range of electronic equipment for ballistics and guidance. In this production, tolerances to 1/10,000 of an inch are commonplace, and we have equipment capable of working to 1 millionth of an inch, and repeating itself. If you have busy told your guidance drive tolerance requirements are "impossible," call your Western Gear man. Write to Box 182, Lynnwood, California for his name and address.

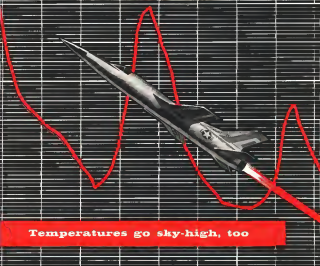


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Aircraft Division

MAN AND MISSELED FLY BOMER, F4U AND SAUCER WITH PARTS AND ASSEMBLIES BY EX-CELL-O.

What Does Grain Size Mean In An Alloy Steel?

The grain size of alloy steels is understood to mean austenitic or inherent grain size. Austenitic grain size should be distinguished from ferritic grain size, which is the size of the grains in the as-rolled or as-forged condition with the exception of those steels that are austenitic at room temperature. When steel is heated through the critical range (approximately 1350 to 1600 deg F for most steels, depending on the composition), transformation to austenite takes place. The austenite grains are extremely small when first formed, but grow in size as the temperature above the critical range is increased, and, to a limited extent, as the time is increased. It is apparent, therefore, that both time and temperature must be constant in order to obtain reproducible results.

When temperatures are raised materially above the critical range, different steels show wide variations in grain size, depending on the chemical composition and the oxidation practice used in making the heat. Heats are customarily deoxidized with aluminum, ferrosilicon, or a combination of deoxidizing elements. Steels using aluminum or certain other deoxidizers in carefully controlled amounts maintain a slow rate of grain growth at 1700 deg F, while heats finished with still other deoxidizers, usually ferrosilicon, develop relatively large austenitic grain size at temperatures somewhat below 1700 deg F.

The McQuaid-Ehn test is the one ordinarily used for determining grain size. Steel is rated with a set of eight ASTM charts that are compared one at a time with a specially prepared steel sample until one is

found to match. Number 1 grain size, the coarsest, shows 1 1/2 grains per sq in. of steel area examined at 100 diameters magnification. The finest chart is Number 8, which shows 96 or more grains per sq in. at the same magnification.

PROPERTIES AFFECTED BY GRAIN SIZE

Fine-grain steels (grain sizes 5, 6, 7, and 8) do not harden as deeply as coarse-grain steels, and they have less tendency to crack during heat-treatment. Fine-grain steels exhibit greater toughness and shock-resistance—properties that make them suitable for applications involving moving loads and high impact. Practically all alloy steels are produced with fine-grain structures.

Coarse-grain steels exhibit definite machining superiority. For this reason a few parts which are intricately machined are made to coarse-grain practice.

The correct specification and determination of grain structure in steel is a subject that has been given long study by Bethlehem metallurgists. If you would like suggestions on this or any other problem concerning alloy steels, these men will be glad to give you all possible help.

In addition to the entire range of ACSI alloy steels, Bethlehem produces special-analysis steels and the full range of carbon grades.

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See the Public Cost Reduction guides we will be releasing under the Steel Corporation's Steel Orderbook. Bethlehem Steel Plans Corporation.



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Air Force Model D4C—designed for the Nonflex Standard refrigeration system used on Chance-Vought F4U "Corsair"



Douglas Model F3D—engine cool tube bundle—designed for Lockheed C-130 "Hercules"



Air Force Model F100—designed for North American's F100 "Super Sabre"

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to others...
we know we
can help you!



emergency fire control
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and write for catalog details on our standard switches.

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precision control
of aircraft landing gear is assured by the complete gear gear assembly which includes Electro-Snap harness.

control problems with precision accuracy...



powering and de-powering
Protection is dependably accomplished with this compact, hermetically-sealed assembly. Automatically actuated, it can be manually overridden. Design utilizes E-S rotary hermetic seal.



fire control switch
assures proper sequence during emergency fire conditions. Eliminates pilot error by controlling all functions when single handle is pulled.

rotary release switch

assures timely control release of fuel tanks and other objects from aircraft. Positive detent action assures fail-safe operation and dependable performance.



rocket safety switch
avoids tandem sockets will fire in proper sequence. Also indicates when rocket has been fired.



accurate control
of landing gear position is accomplished by this precision rotary hermetically sealed switch. Actuating means on other side of cover within extremely close limits.

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► B-5 orbiter, which won't get strength for Florida season, sets conditions for retention of order.

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► Britain's first true supersonic interceptor shown at Farnborough compares favorably with U.S. fighters

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COVINS: Three of four Alouette flying test beds being used by Indians are, top to bottom, Alouette I, Alouette II, and Alouette III. The Alouette III is powered by two Pratt & Whitney T55 engines and Alouette II by two Pratt & Whitney T55 engines and Alouette I by two Pratt & Whitney T55 engines. Alouette III has a top speed of 150 mph and a range of 1,000 miles. Alouette II has a top speed of 150 mph and a range of 1,000 miles. Alouette I has a top speed of 150 mph and a range of 1,000 miles.

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Perspective on Missiles

Grated wonder of all varieties will continue to enter the aerial weapon systems arsenal in increasing numbers during the next decade. Right now however there is a great need for some realistic perspective on just how and when missiles will fit into the defense picture of the next decade.

There is considerable evidence on the public record indicating that the missile has been sold overbly by its non-technical proponents particularly on the vital factors of cost and reliability. There has been a tendency on the part of military nuclear doctors to sell the public and Congress a mixture of "muzzle-consumer" snake oil that is supposed to cure all budgetary and defense ills in a twinkling of the eye.

The recent British defense revision are perhaps the worst example of how a nation can seriously weaken its defenses in order to pursue the missile chimera as an end and successful way out of what are really costly defense problems.

Expensive Integration

The idea that missiles will quickly replace all manned aircraft in the defense picture is no longer given any serious consideration, if indeed it ever was, by top level defense planners. Based on the hard facts of potential missile development experience we know that integrating missiles into the defense arsenal is going to be a longer and more expensive process than was first anticipated.

Missiles will assume their role in defense as an evolutionary not a revolutionary process. Not will they ever completely eliminate the necessity for manned aerial vehicles. This is primarily because of the fact that aircraft have not yet met the test laid to the irreparable future invent an atomic "black box" that can take over the thinking function of a man or even more that function out of certain types of aerial vehicle. Military situations will always (no test safe at least, we hope) require human thought as an essential ingredient for success. That the missile which can relieve man of many mechanical functions will supplant man on the manned vehicles that transport their own thinking mechanisms in the form of pilots and crewmen.

'Ultimate' Weapon Myth

There has been a good deal of nonsense in the public press purporting the thesis that missiles particularly in their ballistic form are an "ultimate" weapon against which there is no possible defense. This is pure popcock. There never has been and is there likely to be an "ultimate" weapon against which there can be no defense. For every new weapon eventually there is developed a counterweapon that checks or lessens its effectiveness. There are already several promising approaches to defense against a long range ballistic missile and lack of progress in this field is due mostly to lack

of imagination in the Pentagon in proving this defensive phase as hard as it is now pushing development of the offensive ballistic missile. Seriously there are scientific avenues that may produce techniques of neutralizing atomic and hydrogen bombs and warheads as the air before they can be exploded on a target.

Missiles must also be viewed as a ballistic development in aerial weapon technology they are doomed by the galloping technology of our times to be just an interim (albeit a substantial interim) in the basic role of weapons progress. As Dr. Theodore von Karman pointed out to a recent American Rocket Society meeting, the ballistic trajectory is basically an inefficient method of delivering a payload either for war or peace and the constant search of science will eventually produce more efficient methods of doing this job. Already the rocket-powered hypersonic glide bomber is looming as the technical horizon as a development that may make the current Atlas and Titan type intercontinental ballistic missiles appear in retrospect as technically simple as Chinese firecrackers.

Missiles will also have to fight their way into the operational performance ratings on a basis of man's performance superiority over their manned competitors. For example the Army's Nike Ajax ground to air missile can't even get in the same ball park with the Convair F-102 and Northrop F-89 armed with Douglas M3D atom-boosted air to air missiles when it comes to the job of locating down jet targets before they are well ahead strategic weapons on a target.

Nike Waste

The billion the Army has poured into load, crewsets and training for its Nike Ajax system, designed at the very best to stop para-engineered bombers over short ranges, is a classic example of military waste through stupid planning.

Seriously it will be a most good as to whether the Boeing B-52 was given to air missiles will do a better or defense job over the ranges required than the Mack 2 Convair F-106 with its atomic missile punch. In the short range bombardment field there should be a similar efficiency yardstick applied to mission performance of manned and unmanned vehicles rather than a blind acceptance of a guided missile because it is wrapped in technical gloss.

As the hard facts of science and reliability are laid in missile programs, we predict that both Britain and the United States will realize that the missile time scale for practical operational efficiency is stretching out. Consequently, at least another complete generation of manned defensive and offensive vehicles utilizing less sophisticated types of missiles as a supplement to their combat capabilities will be necessary to minimize the probability of a strong aerial defense system against any potential disturber of the peace.

—Robert Hots

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WHO'S WHERE

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Edwin T. Appleby, head, **Aluminum Forgings Plant**, Chicago, Ill.

Edwin T. Appleby, head, **Aluminum Forgings Plant**, Chicago, Ill.

Charles S. Rodwick, president and general manager, **Food Industries Company**, division of **Spartan Food Corp.**, Long Beach, Cal.

M. V. McRae, president, **Food Industries Company**, division of **Spartan Food Corp.**, Long Beach, Cal.

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G. Marvin Selden, vice president, **Continental Aircraft**, Los Angeles, Calif.

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Frank W. Crayner, vice president, **Continental Aircraft**, Los Angeles, Calif.

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Maxwell D. Mahood, assistant vice president, **Continental Aircraft**, Los Angeles, Calif.

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INDUSTRY OBSERVER

General Electric Co. members of its steady defense electronics program, ready to determine what percentage of its equipment or techniques have applications in both the missile and jet/aircraft field, reveals that about 82% are applicable to both. Approximately 25% of GE's research development effort is currently committed for specific missile programs.

De Havilland Propellers Ltd. has designated six intermediate size ballistic missile (AW Aug 26, p. 23) Project Six. Test stand visible at Maxfield is for cold flow tests of systems and simulates actual missile parameters.

Defense Department is reviewing USAF's decision to purchase Kaman's HO4's local or base rescue helicopter. Some Defense officials feel the Air Force could save money by purchasing Bell's H-40 for which Army already has borne most of the development costs. Both helicopters are turbine-powered, have approximately same capacity. Bell and Army have agreed to divide the H-40 production contract with USAF, with the Air Force bearing none of the cost for early production models where the cost is higher.

Continued production of the Sparrow II air-to-air missile under license from Douglas Aircraft Co. is being withheld pending a decision by Canadian Westinghouse on the true guidelines the missile should use. Present plans call for production of approximately 500 Sparrows II.

ICRBM and IRBM tests being conducted by Naval Ordnance Laboratory include use of newly developed two-stage hypercooled gas capable of firing propellant at 16,000 psi per sec. When fired at 1000 psi in test, pressure rises to 8,000 psi. 300-millisecond air second later, air combustion chamber first, pressure drops near to 40,000 psi, and ruptures the diaphragm between first and rear chambers. Crossing force first becomes of gas is pressurized front chamber, thus advancing toward the rear, raising pressure to 60,000 psi and temperature to 16,000° F. Heat and pressure combination bursts through front diaphragm and kills the propellant from the barrel.

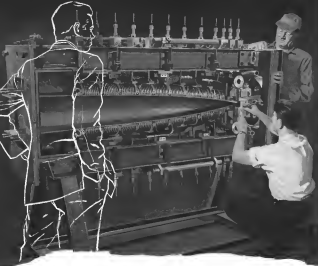
Defense Department is taking a close look at Army's requirement for a three-ton helicopter, calling in Navy and USAF for consultation on the specifications. There is a strong possibility that the three services may reach an agreement whereby one design will be suitable for all three requirements. If negotiations are successful, it will mark the first time an aircraft has been specifically designed and built for the triple military market. Army will use the helicopter for mobility on the field, Navy for Marine assault missions and USAF for transport, probably on logistics missions serving remote landing sites.

Field digging by an Howler Hazards powered by Rolls-Royce Avon turbojets has earned engine blowout hazards which occurred when gas was fired at altitude. Fox is a switch incorporated into engine control that momentarily reduces the fuel flow a split second before firing, drops engine performance for enough below the surge line so that there is no chance of a blowout or stall. Since it is going into its high-altitude version of the Bristol Olympus used for the interceptor version of the Polaris, Gen.

Nagler Flight Development Division at Latona is receiving two Gloster jets for new powerplants. One will carry de Havilland Gyron Junior with afterburner; the other Rolls-Royce Avon, possibly the R A 24R series. Present jets are equipped with two Armstrong-Siddeley turbojet engines.

Rand Corp. is establishing an independent non-profit corporation to undertake the training of an defense center personnel for the Air Defense Command. Rand, utilizing an application of computers, has conducted an air defense radar equipment possible even banking pattern on the U S and has quickly trained average 10 USAF crews how to detect and prevent electronic defense systems.

(Continued on page 117)



HOW THE SILICONES MAN HELPED... CHANGE THE TUNE OF A MACH 5 WHISTLE

Ran a wind thirty-six hundred miles an hour down a wind tunnel 20 inches square. Problems in testing models of supersonic rockets and missiles in such a tunnel gave new dimensions to operational techniques.

Developed by engineers of the Jet Propulsion Laboratory at California Institute of Technology, this advanced wind tunnel presented many unique problems. In order to control the air going into the test section, movable plates were used to vary the area of the opening. The plates, working against air motion, had to be sealed. The elastomer created by this invention (extruded ordinary sealing materials). That is, until Union Carbide Silicone Rubber was used. Fabricated by Reeves Rubber, Inc., of San Clemente, California, in solid strips... in hollow tubing

that is processed for an extra tight fit... this silicone rubber performed exceptional service under almost "impossible" conditions. In fact, tests indicate that maintenance will only be required once every two or three years!

This is another example of how the Union Carbide Silicone Man has helped solve an "impossible" problem. A booklet—"Look to Union Carbide for Silicones" describes silicone rubber and many other silicone products. Write Dept. A959 today. Silicone Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.



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Washington Roundup

Buying Program Firms

Watch for final release of USAF's final 1975 buying program within the next couple of weeks. You will soon be informed by the release of some money day contracts to launch production.

The Defense Department continues that shopping lists have been delayed for the cost part with only enough released to keep essential work going. Nevertheless, these obligations authorize are released at the beginning of the fiscal year, but certain knowledge that contracts will be so large for the future has forced the department to undertake slow review of the contracts to be signed in next few months.

Defense sets any trouble encountered now or in the next quarter, beginning sometime, that involves current bills is a problem of the Air Force, which is going to pay for hardware ordered a few years ago and underpaid at that time. This circumstance has forced the military services to deal not even for current expenditures with current cash.

"If a contractor is forced to borrow cash in order to keep operating," Aviation Week is told, "it is because there is some program under way in his plant from USAF tax pay for and stay within that year's ceiling. He is going to get 60 cents, a special that was picked out a long time ago, and having to go is going to be tough on the books."

No-Show Penalty: Tipton Poys

First passenger to the U.S. to be penalized by the no-show penalty plan shelled out his \$1,500 without visible protest after missing a flight on the West Coast early on the morning of Sept. 15, effective date of the plan. The offender: Stuart G. Tipton, president of the Air Transport Assn., which sponsored the plan.

Notional Strike

National Airlines estimated that 5,000 passengers a day were being turned over to other airlines in the 56 cities along its route because of a labor dispute that brought the industry's operations to a halt last week. National suspended service when members of the Air Line Agents Assn. called what the airline management termed an "illegal wildcat walkout." The union blamed the trouble on an "illegal lockout" of 16 workers in New York. The matter was before a three-man mediation board late last week.

R & D Relief

Alves says USAF research and development cuts generally in the Office of Scientific Research (ASR) Sept. 25, p. 27, Sept. 25, p. 20) has brought great relief. OSR project monies have now been told to fund work, set in every out immediate conclusions as internally planned because the budget still stands at \$16 million plus \$3 million for projects on finished work. OSR now feels it can move on and will feel the pinch mainly in its inability to undertake new contracts.

The action followed a wave of budget protests from manufacturers, who were caught short on the use of a new college year. They can now be helped by the Defense Science Board, which spent its first meeting with Dr. Paul D. Finkle, new Assistant Secretary of Defense for

Research and Engineering, drafting a statement condemning spent R & D cuts. Robert was not an agency. Defense Secretary Charles E. Wilson says he does not know of any programmed cutback in research and development. The trial is to be spent, he added, will remain about the same, so that new projects will be possible and if some of the old ones are cut off "had some of this research and development ought to be finished some day."

Otherwise, it says, are doing a underwriting a liability for some time to come. . .

Long Look

Radar capable of detecting atmospheric-borne ballistic missiles out to ranges of 3,000 miles are "planned for operational employment in the next future," according to Gen. Thomas D. White, USAF chief of staff. White does not indicate whether new long-range radar is the Overseas Digital Radar (ODDR) recently disclosed by Colorado University (AVW Aug. 29, p. 28). Similar developments reportedly are under way at RCA Telecommunications, General Electric, Hughes, Radio Corporation of America, Sperry Rand, Westinghouse Electric and Lincoln Laboratory.

AMB Organizes

New three-man Aeronautics Modernization Board held its first meeting last week following appointment of Defense and Commerce Department appointments—Mildred A. Mackenzie, USAF Under Secretary, and Louis R. Berkebile, Assistant Secretary of Commerce for Trade Promotion. Third member is AMB chairman, Edward Quinlan. President's special assistant for aviation files his planning.

Helicopter Goes North

What became of the helicopter? Outside of the military services, it has gone mostly into the main wing field has become—now 10-year-old Avco Helicopter Assn. has 89 commercial operators in North America. About 180 aircraft. Most of them are Bell 47s which started the whole thing by making the first commercial purchase in late 1946. Biggest business: Oklahoma Helicopters Ltd., of Vancouver. B. C. Canada, with 25 Bell 47s, 17 Sikorsky S-55s and one Sikorsky S-55.

CAB Warning

Civil Aeronautics Board has warned Los Angeles Air Service, a supplemental carrier, that it must operate a reserve flight within the next 90 days or stand to lose its aviation operating authority. As a result of the 1975 CAB action in the Long Inland Air Carrier Investigation Case, supplemental carriers must make at least one reserve flight during every two consecutive inlander quarters.

Los Angeles Air Service has not operated a flight during the past two quarters since it sold off its aircraft leased three last, and then additional three in September 1974. In order for an exemption from the reserve flight requirement, the company says it has purchased two DC-6s for delivery next May at which time it plans to increase operations. CAB denied the application but gave the airline a 90-day period in which to negotiate for the lease of airplanes to operate flights.

Washington staff



LINUP AT BRISTOL includes four of the five fighter entered in the NATO competition in a white smock. In a white smock, left to right are: Fiat G.91, Dassault Etendard 4, Dassault Etendard 4, and Fiat G.91.

Fighters Compete for NATO Approval

Lack of power in all contenders leads observers to believe prize will be limited pre-production order.

Brussels, France—Five entries in NATO's competition for a light-to-medium weight strike fighter finally got off the ground on the same day and at the same place as the long-delayed start of their competitive flight trials.

Teams at NATO pilots, flying the various in reviews, will carry out trials for the next few weeks. Completion of the evaluation is expected early in October depending on weather and aircraft availability. Winners of the competition is expected to be announced late this year after evaluation of the flight reports.

Major treaties played the first day of trials. The Dassault Etendard 4 was tested out of the runway with engine and radio difficulties, and the Fiat G.91 aborted one mission because of trouble in the cockpit.

Engine Lack Factor

The five competitors include three specifically designed by the NATO competition: Dassault Etendard 4, Fiat G.91, and Fiat G.91, all powered by a Bristol Olympus 1 turbojet and at 4,150 lb thrust. They have been joined by two other aircraft which the criteria led to the decision:

Dassault Etendard 4 and Sud Aviation Brumecor, both powered by a SNECMA Atlas rated slightly above 4,000 lb thrust.

First prize could be a production order for several hundred aircraft, but some observers believe that only a pre-production order will be placed for a limited quantity. The reason is that as design of the competing planes has progressed, they have grown in weight beyond the original 50,000 lb limitation and are therefore somewhat under powered. Dassault, Brumecor, and Fiat have increased weights of their basic designs using the more powerful Bristol Olympus 12 rated at 6,000 lb thrust and 3,170 hp, with afterburner. But the Bristol engine is longer and heavier and requires more air and more total fuel to perform the mission. This calls for a major redesign of the airplane.

Consequently the planes presently competing do not represent scrupulously or optimistically the developed version that seems to be needed to perform the original mission. Construction of a series of new prototypes will take time and further delay the program.

Thus the choice seems to be either selecting one of the current crop for pre-production while development of the model's continues, or ordering a production batch of an airplane that will be as judiciously be unable to perform its mission when it reaches service.

Support Role Served

The mission itself has been bitterly criticized in some quarters as unrealistic. It calls for one of the aircraft against tactical fighters—long reconnaissance, ground support, and other duties, instead of a strike role. Some observers believe that the mission is not realistic. They claim that the design and production effort is being wasted on an airplane whose basic concept is geared to a 1945 powered concept.

But NATO and SHAFÉ planners argue that the expected threat will come from a numerically superior enemy stilling out in force at sea or some points along a line of defense. They say the way to prevent this kind of an attack from driving through is to keep the necessary concentrations of material or men from forming. This can be done by tactical strikes against concentrations, forcing the



LANDING BARBUDIUS generates a cloud of dust as retractable landing gear hits the ground in testing. The aircraft, which was built instead of conventional gear, also utilizes a drag chute for deceleration.

enemy either to break them up or to avoid concentrations in the first place.

The turning point of this argument is in the assumption of the type of threat SHAFÉ sees it as enemy action, the extent of it as enemy air or missile assault.

Specific requirements for the aircraft is the ability to deliver tactical weapons against ground targets. The plane is required to take off from a grass field or other prepared surface, and clear a 30 ft obstacle within 1,000 ft after releasing the hook. Climbout is to a relatively low altitude for cruise at 400

ft., followed by a dive descent to the deck and a run into target at Mach 0.95. Return to base is by a center flight plan.

How Project Started

Origins of the project was in studies made at Allied Air Forces, Central Europe, which developed the idea of the tactical light fighter SHAFÉ to fund the requirement conceptually with the start of the U.S. Mutual Weapons Development program. All the NATO nations were told that the U.S. would consider supporting a pro-

gram endorsed by SHAFÉ as meeting the NATO requirement.

Design proposal evaluation was assigned to an ad hoc committee headed by AGARD Chairman Theodore von Karman and the group recommended three designs—Breguet Tuois, Dassault Etendard and Fiat G.91—out of the ten proposals submitted. Both France's and Italy's governments promised to contribute to the support of the program.

Bristol's Olympus was the only engine that would meet the requirements. All three winning proposals specified it.

PARADIGM STREAMING rolled behind the Breguet Tuois (lower) with to stop on the concrete strip at Brétigny. Although eyesight is not required for operation from unprepared fields, most of the trials have been conducted from concrete runways.





TAKING in with canopy lifted, the Douglas B-70 shows its small size, large feet for coping with rougher fields. Note leg and eye steps in two segments.

and it was in part of the long design life.

In 1974 the program started seriously as industrial materials and development programs under national weapons development.

Meanwhile the Kansas had seen that SHAFS would need future technical advice, and organized a permanent advisory committee on the project. There were five subcommittees formed:

- **Manpower and requirements, program guidance** in the construction on design, construction and equipment of prototype models.
- **Flight testing, setting up** the current series of tests as well as helping on

tractors with individual problems of flight test techniques.

• **New developments, responsible** for keeping the weapon system project contemporary with the state of the art. One of this committee's aims was to bring the Dryden 12 into the program.

• **Production and logistics**, to get NATO and national cognizance of the production problems of the airplane.

• **Tactics and techniques**, to guide the initial planning of the SHAFS tactical trial program. This program will use the F-105 F-4U now under construction to develop tactical rules and assist for the weapon system.

As was predicted by observers in

April, NATO found it necessary to review its competition schedule, flight trials were originally planned to take place in the first week of August.

The NATO lightweight support fighter program was launched several years ago. It has been financed mainly by U.S. funds. Original plans called for silencing a strong aircraft, then various NATO countries would plan the production of some 1,300.

Obviously, no public criticism has been directed at the program. But several defense magazines did tell NATO that unless the program was revised they would not be interested in participating (AW April 26, p. 37).

AMB's First Major Program Scheduled to Begin This Week

By Philip J. Klein

Washington—First major Army Modernization Board program will be launched this week when the army launches its major air program. To meet their 400 aircraft contract for contract bids on a multi-million dollar electronic data processing and display program.

Industry will have 60 days to submit proposals for the construction of an experimental data processing and display system using existing equipment and know-how—for delivery in January, 1975.

Service Test

After a year of AMB experimental test and modification, the system will then be installed and service tested under actual operational conditions, probably in the New York area.

AMB's air traffic control distribution program is the first of five major programs the new agency is expected to launch in the next few months. The others, in five phases after all projects are started, concern: communications, radar data collection and storage.

Approximately 100 representatives of more than 400 aviation companies are invited to attend the industry meeting held last week at AMB's invitation in New York. Officials gave a preview of the program and its objectives.

Program aims at speedy application of man-made computers and data processing equipment, developed for military or commercial use, to accelerate the handling of information used in air traffic control.

Many of the data handling and display techniques now in use date back 15 to 20 years.

AMB's request for bid will outline in broad terms the operational requirements for the ATC distribution system, including:

- Accept data from variety of sources, including radar, teletype, telephone, voice radio and military data link.
- Compute automatically such things as maximum altitude of each aircraft's position, based on flight plan or position reports, estimated time of arrival into terminal area.
- Display aircraft position for en route, terminal area and airport surface maneuvers.

Operational Tests

AMB officials emphasized that equipment must be designed for maximum flexibility to permit modification of control procedures and techniques dur-

ing the 12-18 months of experimentation that will follow system delivery in January 1975.

Present schedule calls for installation of the equipment in the New York area beginning by about January, 1969. System will be evaluated for six months and terminal area operations using two or all three of the major New York airports, plus a private airport, satellite base and off-shore naval operations, an AMB spokesman said.

It also will be tied into SAGE air defense system.

Experience gained in these tests will provide basis for a production design program that is scheduled to replace the experimental system in New York area around early 1975.

Similar ATC distribution and display systems may then be programmed for construction and installation at various other major terminals around the country.

Tight Schedule

Concerned with the actual work on the experimental system, AMB's staff of engineers and operations personnel expect to make analytical and scientific studies of the validity of traffic control and terminal area concepts proposed by the Curtis Committee report to the President on airway modernization needs.

As changes in operational doctrine suggested by these studies will be incorporated in the design of the experimental system.

To provide guidance to the selected contractor in designing controls and displays that are compatible with traffic controller needs, the board plans to send several traffic controllers now on duty still to work alongside contractor's engineers.

Some manufacturers were warned that they must use existing equipment and proven techniques to meet AMB's tough timetable. The contractor's job is to design existing equipment into a system suitable for air traffic control, developing only the blank areas needed for this project.

Army's Modernization Board is hopeful that the timetable can be met particularly since a number of aviation companies have had the ATC data system problem under study for some time using their own funds. This includes such companies as General Electric, General Precision Equipment, Hughes Aircraft, International Business Machines Corp., Radio Corp. of America and Sperry Rand.

Recognizing the magnitude of the job to be done, AMB has encouraged smaller firms to form coalitions to compete with the industry giants.

Although AMB officials decline to indicate type of contract which will be employed for the development, it is believed that a cost-plus-fee (CPIFF) form will be used to provide flexibility in evaluating system design changes during the program.

Grumman Prices Gulfstream Executive Transport at \$700,000

New York—Price of approximately \$700,000 will be set by Grumman on its new Gulfstream two-engine 30-12 passenger turboprop-powered executive transport as delivered to distribution minus completed options and with low weight and communications equipment, Aviation Week learned last week.

Official announcement is expected to be made during National Business Aircraft Ass'n's annual meeting in Denver, Colo., this week.

Grumman appointed three distributors in the United States who will take orders, enter buying orders and install complete systems and equipment in customer's office (AW July 8, p. 26): Atlantic Aviation Service, Inc., Philadelphia; Pacific Aviation Corp., Burbank; and Rossmore-Winters Corp., St. Louis. The service already have accepted some deposits on the airplane for 1975 delivery. First Gulfstream is scheduled to come off Grumman's Bethpage, L. I., N. Y., production line April 7, 1975.

Here is payment schedule for distribution when entering the airplane from Grumman:

- \$100,000 deposit when order is placed with Grumman. This goes the distributor's production priority.
- Payment of 25% of total cost, minus the deposit, when Grumman ships a production line number to the engine, normally 30 days prior to start of actual manufacture.
- Second payment of 25% of total agreed purchase price four months prior to delivery.
- Final payment, comprising 50% of total cost, upon acceptance of the airplane by the distributor.



Defense Money Squeeze Detailed

New York—Full report of Defense Department's recent fiscal gloominess will be felt by the aircraft and other industries in the October-December quarter, and the fiscal 1958 total of new business will be about \$10 billion, according to Willard F. McNeil, Defense Department consultant.

McNeil told the National Security Industrial Assn last week that the amount of new business placed in July and August are small—in the price-mechanism of the market. He said the program fields the total direct obligations for fiscal 1958 will be about the same as fiscal 1957—over \$39 billion.

In the separate case of current expenditures, McNeil said the program is great optimism that the amount there on going to see the light is not below \$35 billion by any one margin. Figures on the expenditures rise for September and October, he said, "will be decisive."

Defense Secretary Charles E. Wilson has set a \$70 billion spending ceiling for the first half of the current fiscal year. McNeil says it will not be cut less than September and October last

year does not show a significant decline.

McNeil said he hopes substantially all program adjustments have been made. Many industry observers do not share this optimism and McNeil himself added that in a "quite possible" that construction may have to be given to some further adjustments.

He led the warning for the aircraft industry.

"Aircraft industry employment by the end of the year will be about 20,000 to 25,000 from the 300,000 peak in April of this year. A much more substantial factor than this is to be expected when all the secondary industries, already announced, have been taken."

"Overhead in the aircraft industry is down appreciably, but not down enough."

Earlier, McNeil said that in the last fiscal quarter of the year aircraft production in a surprising number of aircraft plants accounted for more than 35% of the total output, and in one of two plants reached 28% of total output.

McNeil pointed out that this year's expected output of \$18 billion on expenditures is only about 1% less than the fiscal 1957 size of \$18.4 billion. In the latter part of fiscal 1957, however, the Defense Department was spending not directly at the rate of \$10 billion a year and the adjustment to this figure amounts to about 5%.

Missile Delegates Are 'Watching, Waiting'

Washington—Representatives of about 16 industrial concerns attended an organizational meeting of the National Missile Industry Conference last week. A proposed conference of corporations and its laws were outlined. Delegates said the program most of the proposed new group will be the National Rocket and Missile Industries Assn.

Delegation queried by Aviation Week indicated that most of the companies have a "watch and wait" attitude toward the new group. These units said they were uncommitted and merely are reporting their own activities to management. The declaration was made that only two possible passive contractors were represented, and one of these had asked the permission for an application to attend.

The law specifications that NNIC possibly will be developed as organizations of subcontractors and suppliers in the missile and rocket area. Some of the delegates at the first session feel also

there is a prearranged help between the organization and Missile and Rocket engineers, although the impulsive action may lead against letters in behalf of the effort. AV Week Sept. 23, a 37% hike in the program before the meeting got under way.

Kenneth K. Hart, a Washington publicist who served as moderator of the meeting, told Aviation Week there is an ongoing meeting between NNIC and Missile and Rocket. He said the meeting left the organizing group of missile component manufacturers standing on their own feet.

Hart, who has made a career of organizing Washington governmental affairs for such groups as the Aircraft Manufacturers Assn and the Independent Air Transport Assn, said he is now serving as the acting secretary of NNIC.

He had no financial arrangements have been made but that he is glad to contribute his time if it serves a good purpose in launching NNIC.

Hart's contacts in the organization will act chiefly with existing organizations, particularly the Aircraft Industries Assn, and that there is a need for a clearing house on missile industry information.

He claims that government agencies so far have difficulty obtaining useful statistics on the industry and that NNIC will fill the void.

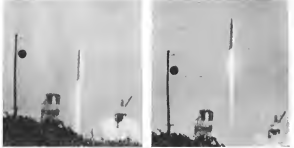
Representatives present at the first meeting from Navy's Bureau of Aeronautics, Army Ordnance Corps and USAF's Office of Scientific Research and Air Materiel Command. A second meeting will be held on October 22.

British Want Navaid Tests; U. S. Resists

London—Adoption of an interim test and training long range navigation system is to be held in view, so the opinion of states delegates to South Commission's Technical Meeting of the International Civil Aviation Organization.

U. S. and Great Britain officials dampen an opposition to both short and long range navigation. British delegates are pressing for an early interim test conference to evaluate available systems including their short range system in operation, and Decca long range system is expected to establish test with the next two months.

U. S. delegation is making no move for its early international conference. The British delegation, member of the short range system, would hold a meeting with its proposed-Navaid, Loren C. [Cable] and Omega—expected to take three to six years.



DOUGLAS THOR leaves the launching pad in an successful firing tests Patrick AFB, Fla. Thor, which employs a rocket design to add strength to the engine, needed at just 1,500 m. Thor boost Thor's position in competition with Avco's Jupiter.

Successful Thor Bolsters USAF Hopes

By Claude Wizer

Washington—Successful firing of the Douglas Thor intermediate range ballistic missile has bolstered USAF confidence there will be an marriage of Thor with the Avco-developed Jupiter (BMR) and that Air Force's Ballistic Missile Division will proceed with development and production of the Douglas Thor in a long-range "near successful" firm we hoped for," the Thor tested at least 1,500 m from Patrick AFB, Fla., on Sept. 20.

On the day of the successful firing, it was declared that the Army Ballistic Missile Agency of Redstone Arsenal already has allowed the basic structural design of Jupiter to employ the auxiliary and subcarrier technologies used on Thor. Avco's Wizer learned that Thor's structure basically comprises a self-design, adding strength to the airframe much after the fashion of jet propulsion in the sheet metal employed in auto and similar structures.

Redstone Visits Douglas

About three months ago, according to a reliable source, a team from Army's Redstone Arsenal visited the Douglas plant in California to examine the basic structure of the Thor. Army Ordnance Corps immediately ordered changes in Jupiter to jettison it after the more sophisticated USAF missile.

It was pointed out that Air Force work on this problem of structural de-

sign, let factors on the structure ratio of fuel weight to total weight, is an odd in the airplane world in the missile field. USAF has been working on capon-ments for use in missile development in the World War II and the achievements were being used in USAF's intermediate ballistic missile—Atlas and Titan—as well as Thor before they were adopted by the Army. Further savings have been obtained by using a wet-on rocket engine, making it possible for Avco's Jupiter to use the same engine developed for Thor. This unit, product of the Rocketdyne Division of North American Aviation Inc., also is one of the possibilities outlined on the Constair Atlas ICBM.

Thor's successful firing was made on the fourth attempt to get the missile into the air launching and at Patrick.

First shot got only a few feet off the pad before being destroyed by fire. Second shot was prematurely destroyed at flight by the range safety officer who is fully governed by automatic. Third shot went only a few miles before going off course.

The fourth attempt was made at a range base in the delineation of the Defense Department's three-man committee which was trying to decide on the relative merits of the Thor and Jupiter designs and how they best be turned could be rolled into a single weapon system.

After about a week of close studies

at the Pentagon, it was reported the committee stood with an impetuous three-way split. Maj. Gen. Bernard A. Selenner, commander of USAF's Ballistic Missile Division, favored Thor; Maj. Gen. John S. Medaris, chief of the Army Ballistic Missile Agency, stood firm for Jupiter; William H. Hobbs, special assistant secretary of Defense for Guided Missiles, was not concerned.

In the early hours of the day Thor was scheduled to fire, Hobbs himself left the Pentagon and was flown to the Florida test station. He was joined there by Donald A. Quarles, Deputy Secretary of Defense, who was at Patrick for a short vacation. Quarles is a former SAC chief of the Air Force and former Assistant Secretary of Defense for Research and Development. He is a strong vocal expert on guided missiles.

Wilson View

Pentagon chairman last week expressed confidence that Hobbs' views were retained from Douglas, will settle the ICBM question, probably including the USAF-Douglas issue.

Defense Secretary Charles E. Wilson is concerned about how the decision will be acknowledged on the eve of the Thor demonstration that he had granted the committee some time to study a decision. He hoped to announce his decision before he is off next week.

Another possible factor in the final decision is the rejection by Wilson of a

Atlas Test Firing

Patrick AFB, Fla.—Firing of a second Constair Atlas intermediate range ballistic missile after a successful test last week was scheduled as a test of the weapon's speed in attitude capability.

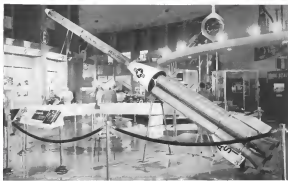
The Atlas experiment was fired this week on a regular performance. It entered a steep nose dive, as seen by observers on nearby beaches and it probably was scheduled for destruction as soon as the power switch had been cleared. The high speed rocket needs to be destroyed.

Witnesses said the missile began to dash about three miles at approach height path after the firing sequence had been set. About the time the second stage should have taken over, the Atlas moved downward with three and a half miles in its tail. At this point, the attack was destroyed from the control post.

Approved missile was that no much had been passing into the powerplants. The engine had first ignited, then choked off the motor.

Despite its short duration, the flight produced significant data and was turned into a success from an engineering and technical point of view. Errors for the shot, which technicians have noticed, was not the same as that which caused the destruction of the missile in the first firing last year (AV Week 12, p. 17).

Firing was watched by Donald A. Quarles, Deputy Secretary of Defense



Farside Rocket Displayed

Four stage solid propellant rocket for launching from a balloon at Pequet Flats is displayed at American Ordnance Arm meeting in Detroit. Ford Motor Co. subsidiary, Aerospace Systems Inc., is prime contractor for system designed to reach height of 4,000 ft. First stage is four Thiokol Rocket motors, the second is a single Rocket. Third is equipped of four General Control motors now used in A-7F loading rocket, and fourth stage is a single APF motor (AW July 27, p. 23)

suggestion that the Chevrolet Corp. plan to build a new muscle factory in Birmingham, Ala. near the Buicktown Arsenal (AW Sept. 21 p. 10).

Quipped by Anthony Weiss, Wilson did not get into all such a Chevrolet proposal although, "According to some people they have got a subsidiary, there are."

Wilson added that a new facility should not be needed for the IRBM and he would "look with a cold and fully eye" on any plan to build a new plant.

ICBM Defense?

Secretary Wilson also took note of recent claims by Army proponents that an effective defense against the ICBM is technically possible, a viewpoint that divides sharply with more pessimistic statements from USAF experts who are charged with responsibility for an defense.

"I am afraid," Wilson said, "there is a certain amount of talk going on" by people trying to "talk out a claim for a future development program."

There is some possibility that the IRBM defense will be made after Wilson leaves the Pentagon and turns his job over to Neil H. McElroy. On the day of the successful Viet Cong,

McElroy was a visitor at Gen. Schriever's headquarters in California. Late this week, he is scheduled to spend a day at Redstone Arsenal in Alabama, he will visit plants of major aircraft manufacturers and USAF installations.

Long-Thrust Rocket Used in Temco Drone

Redstone, Okla.—Sobell solid-rocket motor which powered the Temco NKD1F drone is its first flight appearance in a major scientific breakthrough, according to Phillips Petroleum Co.

Flight of the Temco drone (AW Sept. 16, p. 30) marks the first successful use of rocket-powered target drones which require long periods of sustained thrust, Phillips said. The rocket motor was designed and built by Phillips and built a Phillips solid fuel rocket from "readily available petrochemicals."

In developing the NKD1F rocket motor for Temco, Phillips said it solved these problems:

- Obtaining high densities of more than eight ounces
- Using solid fuels that provide in the same motor both initial boost and subsequent sustained thrust without power interruptions

- Combating heat to protect electronics and metal parts from damage
- Providing satisfactory light-weight metal parts

The test motor was ready for flight last week after performance requirements were established. Phillips says the short development time was made possible by previous achievements of coauthor scientists who have developed a series of solid propellant rockets that feature a variety of thrust and duration.

New Unit Increases Telemetering Range

Dallas—New 200 watt FM transmitter has been developed by Texas Instruments to increase electronic range of FM/PM telemetry. New transmitter's operation is complete in a single unit and requires no simplification of output.

Texas Instruments points out that circuit power will be especially valuable for telescoping the terminal phase of cosmic flights when weak signals are blocked out by background noise. The company says greater power will extend transmitter range considerably beyond line-of-sight limits imposed by present

types of transmitter equipment. New unit occupies 67 cubic inches of space and is smaller and lighter than current 36 watt transmitter used for similar data. It transmits at the 115.25 mc range with frequency stability of plus or minus 0.01% up to 75 degrees F.

Higher frequencies are possible with slight modifications, and modification can lower power output to as little as 25 watts.

Operation at 200 watts requires 12 dbm of external cooling air. Integrated heat sink provisions stretch out the transmitter's operation during periods of rapid heating up, reducing the rate to such levels that allows an in-rush into the atmosphere, according to Texas Instruments.

Australian Line Orders Lockheed Electras

Washington—Austrian-Australian National Airways last week ordered four Lockheed Electra jetliners. The four jets at a cost of \$12 million including spare parts.

Lockheed Aircraft Corp. and the airline (largely the total Electra sales to 141 aircraft).

Deliveries of the transports to Ansett Airways are scheduled to begin in December, 1958. The aircraft will carry 66 passengers in a deluxe cabin seating, plus a second lounge. They will be powered by four Hamilton Standard 501 turboprop engines, developing 3,750 hp each, and Aeroproducts turbo-boosted propellers.

The cropped Ansett-Australian National Airways routes cover 17,474 miles in Australia and Tasmania.

Soviets Claim Record for Tu-104A

Moscow—Kazak is claiming new speed and 30 seconds for its Tu-104A, two jet transport.

On its Moscow flight from the Ukraine State the Soviet claim that it set a 200A speed record in the USSR record book.

- Reached an altitude of 12,213 meters (39,884 ft) covering 30,015 kilometers (18,657 mi.) of average speed to 2000 meters.
- Flew 2,080 kilometers (1,292 miles) with 200 metric tons (4,410 lb.) of cargo at an average speed of 597.86 kilometers per hour (371.54 mph).

The achievement will be announced to the Fédération Aéronautique Internationale (FAI) for certification as world records for the best of jet transport aircraft.

Curtiss-Wright's Hurley Replies To Rep. Hebert Contract Charge

Washington—Queries of whether Curtiss-Wright Corp. "baked out" a possible contract—Strohliker-Pickard Corp.—with government contracts or otherwise, a possible concern in the national defense interest continues to be disputed.

At Jolt's hearing, Rep. Edward Hebert (D-La.), chairman of the House Armed Services Subcommittee on Procurement, on saying that "it cost the taxpayer \$25 million to search" the contract of GE J47 engine from the General Electric Co. to Strohliker-Pickard for the specific purpose of building the private firm (AW July 27, p. 23).

Hurley Reply

In a detailed statement challenging the Ray T. Hebert, chairman of the board and president of Curtiss-Wright, stated that his firm "devoted several months in trying to work out a plan to take over the Strohliker-Pickard defense contracts, conceive large defense contracts, conceive large defense contracts, over Strohliker-Pickard lines hereafter, keep 10,000 people employed by Strohliker-Pickard, its donor organization and supplies from losing their jobs, receive a million Strohliker-Pickard contracts that their associates will be good value and get together to 120,000 stockholders that their company had a fair chance of survival."

Hebert reported that after Curtiss-Wright accepted the management of Strohliker-Pickard under the name of a wholly-owned subsidiary—United Bond Corp.—the firm secured new defense contracts totaling over \$45 million.

Rep. Hebert retorted that Hebert's report "clearly established the fact that Strohliker-Pickard was saved from bankruptcy and 'baked out' by Curtiss-Wright at the expense of the American taxpayer through the purchase of defense contracts. The use is even as set forth. Mr. Hebert's statement indicates that instead of costing \$25 million to the taxpayer, the deal really cost many millions more.

Mr. Hebert's statement indicates in excess of \$25 million for stock directly attributable to the Strohliker-Pickard corporation."

Hebert Objectives

"I really admit," Hebert continued, "that using Strohliker-Pickard can go for the economic position of our nation at the moment but I cannot agree that a private industry should have been 'baked out' comprising an existing defense contracts in the past."

In taking over the Strohliker-Pickard Corp. in the name of the United-Bond Corp. subsidiary, Hebert said Curtiss-Wright "paid" the following:

- \$25 million advance payment of 12 years' lease of two Strohliker-Pickard plants
- \$8 million for purchase of work in progress
- \$15 million to assist Strohliker-Pickard's investment in the Acropolis Development Corp., subsidiaries of the Army's DART assets

Hebert said Curtiss-Wright agreed to these arrangements "provided it secured the approval of the Department of Defense at the amounts needed to maintain the defense facilities and to return the successful and successful operation of the plants."

Contracts Acquired

- Included in the \$95 million in new defense business acquired by the United-Bond Corp., after its incorporation by Curtiss-Wright was:
- \$20 million for the Army's DART
- \$12 million for production facilities for Ford & Wherry J57 components
- \$20 million in additional subcontracts from Ford Motor Co. for J57 parts

Noting the expected shut-out of J57s, Hebert declared "We expect the Defense Department to provide other business to replace the lost J57 production."

Employment Decline

Washington—Impact of defense spending cuts on aircraft industry employment (AW Aug. 4, p. 26) has begun to be reflected in Bureau of Labor Statistics figures and Labor Commerce Department reports.

Production BLS figures for July are lowest but work shows a drop of 1,800 workers from industry's all-time peak of 808,100 last April. Average employment over 1955 was 802,000.

Lower Commerce reports for August note that "employment in the aircraft industry showed its first substantial net loss since the recent upward which began a year and a half ago," but gave no figures. Following an BLS figure loss last March:

| | |
|---------|---------|
| • March | 809,480 |
| • April | 809,000 |
| • May | 808,000 |
| • June | 807,600 |
| • July | 802,200 |

Navy Takes Firm Stand on Ban Against Contract Pilot Training

By Katherine Johnson

Washington—Navy officials stand pat as its longtime posture against contract school training of its pilots, despite strong pressure by the Aero-Naval Training Society.

The society's position is strongly buttressed by a study made for the Navy by Robert Heller and Associates, Cleveland industrial consultant firm, completed in December, 1975, but released only last week. The study recommended:

- Use of contract schools instead of the Whiting Field facility near Pensacola, Fla., "could" result in an annual saving of almost \$7 million in Navy's primary training program.

- "Density of flight training provided at contract schools compares favorably with Navy training and is quite possibly superior."

- "Quality of formal military training provided at contract schools compares favorably with that given in the Navy."

A contractor's military atmosphere can be developed and maintained at contract schools. "There is more classroom for students to receive a course among students at contract schools than among Whiting Field students."

- Use of contract schools for primary pilot training is a necessary overall military strategy to be free responsive of Navy personnel now engaged in primary training duty and utilization of the aviation talents of pilots who, because of age or other reasons, are not available for contract school training, for losses reducing the nation's

military strength, leads to broader the base of that strength.

Navy said a law considered the study, which cost \$40,000, is an advisory and working paper for use within the Navy but released it after pressure from ATIS.

Study Aim

The purpose of the Heller study, it said, was to furnish specific financial data in one phase of the Navy's pilot training program, primary training, so that the Navy could evaluate this factor more often. It assumes that Heller went far beyond its contract area in making cost-of-services studies.

Navy's objections to the findings of the Heller report are these:

- Flight training is a "specification" of a naval officer. The primary interest of the Navy is military training and that can only be accomplished from contract with a naval officer flight instructor.

- Heller report considers only savings that might be made in one segment of pilot training, without reflecting the additional costs that might be involved in the total pilot training and because of the type of training. Advancing that with the "savings" figures are available, Navy estimates that the total cost of training of a naval fighter pilot is between \$100,000 and \$120,000, cheaper than the training of a comparable USAF fighter pilot.

- Although the Heller report recommends for contract training, report gave some validity at a period of expanding aviation activity and has some in the contract period of retrocontracting. Navy notes that in its estimate of savings through contract training, the report does not take into consideration the cost of change orders and maintaining established Naval facilities and the cost of additional facilities that would be required at new contract schools.

ATIS Writes Wilson

ATIS President S. J. Solomon has written Defense Secretary Charles Wilson urging implementation of the Heller recommendation for Navy retraining for primary pilot training. Noting that USAF has ordered its contract, Solomon said, "We feel that an urgent selected opportunity is now available to the Navy to utilize the services of two or more primary flying school contractors who were first being selected to be used in the needs of the Air Force."

Navy, however, is confident that its decision against contract school training of its pilots, will not be overruled for these two reasons:

- Navy's new plan to complete primary pilot training will make savings for a number of those contract schools as the Heller report. Navy's goal is to cut the period from 24 to 16 weeks. But the major focus of the plan will be to introduce flight training earlier and cut back the period of weekly pre-flight instruction. Since the biggest volume of "wash outs" occur in flight instruction, Navy estimates that major savings will result in having the "wash outs" occur earlier.

- There would be too much congressional pressure against closing a major complex of the Pensacola base.

News Digest

Edgar Schaefer, Northrop Aircraft Corp. vice president for technical research, will resign effective Oct. 31, and then will act as a consultant to Northrop. Schaefer will establish his own research and development firm, the facilities of which will be used as his consultant work with Northrop. Schaefer's new company will work in several fields in addition to supplementing Northrop's advanced programs in weapon system development.

General Electric established a T84 project to develop the aircraft-developer's gas turbine engine in the 2,600 hp class. Navy awarded \$58 million contract for development of the engine last May.

Boeing Aircraft Corp. secured follow-on production contract for 1,700 hp jet-turbine fuel tanks for B-77 bombers. Contract was for \$10 million.

R. F. Goodrich Aviation Products captured lead and berthing contracts awarded by West Coast Landing Co. at Rocky, Calif., jet facility for research and development in rocket propellants.

Convair San Diego will soon start a \$2,500,000 renovation of its engineering buildings which house some 4,700 personnel. Construction bids are due Oct. 11, with 15 months estimated for completion. Architects are Padonick, Mitchell and Dean of San Diego. Five Westcoast air carrier pilots resigned.

Sole Aircraft Co. received a \$4,500,000 contract from Air Mineral Company for turboprop powered airborne ground-to-air and space. Company's TB-100 turboprop is being tested at the jets, which will be installed in KC-97 tankers. Contract is a follow-on to those tankers which jet students have been built and installed in seven or refueling squadron airplanes.



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AIR TRANSPORT

Britannia Delays Hit BOAC, Northeast

Because aircraft won't be ready for Florida season, U. S. airline sets conditions for retention of order.

By Glenn Curtiss

New York—Curtiss said the new British-certified long-range Britannia will not arrive in Northeast Airlines Florida route in time to capture the carrier's backlog in the highly competitive market this season. He caused Northeast to demand a combination of the deal is to go through at all.

Northeast, which announced U. S. buyers of the big turbo-prop jet, go ahead with purchase plans only if such arrangements are worked out with British Airways Co. These would have to include extension of use deadline to next October and Civil Aeronautics Administration certification by May 1.

Fall Delivery

Northeast originally had hoped to get its first two Britannias in October, the last third in late November, and a third in December. Now that the plane, clearly will not be available for this winter's peak traffic in the Florida area, Northeast doesn't want it until next fall for the next peak season. And the order is contingent on full CAA certification by the May 1 date.

The engine snag problem, not the landing gear modification problem, is quoted in Northeast's Britannia (AVY Aug. 5, p. 37) as the main uncertainty about U. S. approval. Curtiss' problem has been linked and the modifications is considered routine, although it adds about 700 lb to Britannia's gross. No other Britannia customer is involved in the landing gear fix.

Northeast also will have to reorganize its fleet, banking to adjust to the delay. Curtiss' position was to be clarified late last week at simultaneous press conferences scheduled here and in London in the wake of these developments in the Britannia situation.

•British Overseas Airways Corp. only could publicly complained about costly delays in delivery of the turbo-prop jet. BOAC also noted that engine snag problem had not been fully solved.

•British's Ministry of Transport and Civil Aviation approved certification of the Britannia 312 and 313, but noted that operators are advised to avoid prolonged flight in certain conditions because of possible snag effect on the Proteus 735 engine. Throttles of

Proteus 735 is visible between 102 developed during long flight in early 1955 and have been a major cause of delay in Britannia 312 production.

•British issued a statement indicating the engine and tail fin snag is not performing all commercial operations for which it was designed.

•BOAC renews its first 312 and the plane was scheduled to arrive in this country last September. Air posting will go to Al Royal Airforce back delivery of its first Britannia.

•Aerovias de Mexico expected its first Britannia to arrive next month.

•Canadian Pacific Airlines may get its first Britannia this month as originally scheduled, now begins for January, 1958, delivery.

•Howard Hughes now reportedly still negotiating with British for Britannia the "Tiger" and "Tudor." BOAC is said to be willing to release four of its Britannia 312s to TWA if the British government also is. Transfer would probably involve payment to TWA of a premium of \$2.5 million each jet and about the cost of the plane to composite BOAC for loss of revenue. Cost of the airplane without spares is \$3,450,000. TWA refused comment on the suggestion.

•Peter Mandel, managing director of Bristol, was scheduled to arrive in New York last Friday for the press conference here on the Britannia situation.

Bristol Defense

In answering queries of Britannia's certification, the Ministry noted that a special committee set up to cope with the Proteus snag problem still is working to set a permanent solution.

The issue further concerns no problems with the Proteus on its route will mean its first posting flight next month. Its first airplane is 25% over specification in performance, EI Al says.

Canadian Pacific Airlines was supposed to get its first Britannia this month, now being for initial delivery next January. CPA's order itself depends the first of its two Britannias in service at New York international airport about October 25, as scheduled.

British Airlines led to a statement that its long-range Britannia had for the previous two days "been the subject of track clearance which has in-

terference since set at the route. The carrier said equipment was available, a spokesman said, but "we want to make 99% sure."

•Bristol spokesman, BOAC's managing director, complained this month that the delivery of Britannia 102, and 312 had caused him to be great from cost loss. Delays in the 312 alone, he said, would cost him one million 574 million and might put it in the red instead of the black this year.

BOAC's first transatlantic Britannia was expected to begin last April, but was postponed as each 1955 Bristol-type ordered losses at 5700,000 each for only 111 airplane order aircraft and 52,100,000 each for each 312 airplane without engine another plane.

BOAC also has entered the Proteus snag trouble, reported 44 accelerated engine repairs in the Britannia 102, including 35 repairs caused by long-

Other Troubles

In addition, BOAC's 102s, according to the airline, have suffered a series of unrelated faults, such as hydraulic oil leakage and engine failure.

BOAC said the prototype 312 runs 7% below minimum range requirement. Southampton Airlines carried a batch of attacks on Bristol from the British government.

BOAC and Bristol are working jointly with operators on Britannia problems, however, the airline reports, and BOAC has a great deal of both in both Britannias.

EI Al Bristol Airlines has renews of its first Britannia 312, expected delivery of the second last week, and of the third in the end of October. EI Al hopes to get a scheduled Britannia on the North Atlantic by Dec. 7.

The issue further concerns no problems with the Proteus on its route will mean its first posting flight next month. Its first airplane is 25% over specification in performance, EI Al says.

Canadian Pacific Airlines was supposed to get its first Britannia this month, now being for initial delivery next January. CPA's order itself depends the first of its two Britannias in service at New York international airport about October 25, as scheduled.

British Airlines led to a statement that its long-range Britannia had for the previous two days "been the subject of track clearance which has in-

errible gauge rise to speculation and sales at home and overseas.

Despite "great public interest," Bostel maintained, the manufacturer had found itself somewhat "glibly" to avoid controversy and, because of several important letters about the Britanna, was facing the prospect of a lawsuit. Following today's statement by the Ministry of Transport and Civil Aviation, it becomes highly likely that the facts about the Britanna are correct perspective.

In regard to engine usage, Bostel's comment cited the Ministry's statement that the plane's fuel consumption is "considerable" at approximately 1,000 gallons per hour. Bostel noted that the Air Registration Board had not estimated the authorized overall fuel for the original Protone 705 (over 180 gal) in 1980 and reported that engine fuel tanks have proved production deficiencies, capable of meeting continued usage requirements in all respects. "The planes," Bostel said, "are not, as was inferred from performance in the prototype, as good as the current 705. Thus there is no longer any room to suppose the aircraft lacks the range necessary for regular nonstop service on the North Atlantic.

Range deficiencies of the prototype, a Bostel spokesman told AVIATION WEEK, was due to drag not present in the production airplane and to modifications of the latter now necessary.

Bostel's statement said the usage problem, though unsolvable, is well understood.

The Ministry's announcement refers

to prolonged flight at altitude, at altitudes above 18,000 ft, in a narrow band of temperatures about the freezing point and in heavy concentrations of water or ice, an unusual condition to be avoided. It may be the relevant flight altitude, an integral part of the certificate of airworthiness, as expounding the advice to operators. The advice is not a mandatory limitation, the Ministry pointed out.

icing Conditions

Specifically, the onboard conditions that may cause trouble are clouds and rain or drizzle between 5 and -10°C (above between 10,000 and 12,500 ft, standard atmosphere between plus 15 and plus 25, and ground water level) except in 15° to 20° in one cubic meter of moist air's upward flow, seven micrometers of the Air Registration Board that a normal certificate of airworthiness for public transport be restricted to the Britanna 311 and 313 series.

Noting the background of the Protone among failures, the Ministry said, and the engine occasionally proved normal drag tests applied to other engines. The "peculiar susceptibility" of the Protone is typical usage conditions because applicable in the course of BOMG, proving flights about 18 months ago, the state report said.

"It was not the difficulty, at first and was encountered during test proving flights in Africa," according to the statement. "It was proved that flight through heavy concentrations of dry ice resulted in what are known as frost-outs."

To overcome this particular difficulty

and to avoid efforts being made by Bostel and BOMG, a special committee was set up under Dr. G. W. Gardner, Director of the Royal Aeronautical Establishment, a group of representatives of the Air Ministry meteorological office, Ministry of Supply, Ministry of Transport and Civil Aviation, Air Registration Board, BOMG and Bristol. As a result, engine modifications were made which would be required to be fitted to the aircraft and enabled BOMG to begin passenger operations with Britanna 100 series aircraft in February last. Further opening, expansion, however, and in a further expansion of operating conditions in India and the Far East showed that although the engine is modified could cope satisfactorily with dry ice it could still be affected by certain conditions of air crystals and water occurring together.

Study Proposed

The problem posed by this last discovery has yet to be fully solved but the Ministry has ordered a study and a number of promising lines of investigation are being actively pursued by the committee. The Ministry is advised that the aircraft can be flown on routes which are being planned to avoid the worst ice conditions.

With this in mind he has accepted recommendation of Air Registration Board.

The government has made it clear to all concerned that they see most reasons that the problem should be quickly solved so that the full potentialities of the aircraft can be realized.

Subsidy Lines May Retain Sales Profit

Advises would prefer passage of the Capital Gains Bill since it would give all subordinated interests permanent status of equity. The contractor's decision would affect retention of the profits as an effect against subsidy providing the common consented a need in order to reorganize. A final decision by the Board similar to the contractor's would affect retention of the profits upon passage of the bill, industry believes, since it says the CAB already has the power to do substantially what the bill is designed to do.

Case of Retention

In the case before the CAB, advice contained that retention of capital gains is essential to meet that reorganization program, required for reduction of subsidy, and, perhaps, to meet decrease needs and international consider status as well as to respond public needs.

The advice says approximately 5070 million in new flight equipment and

530 million in additional working capital could be required by the end of the century for the industry for 1990. Against that figure, 990 million is available from depreciation. 550 million less net earnings, 567 million is net capital gains of 515 million in 1990. The amount would increase to 5147 million.

Sale Dumper

This said further that condition of capital gains would render the sale of equity capital virtually impossible and/or increased capital gains by merging and dividends record which has shown an average net profit of 3.5% since 1985. Of the 29 airlines in the case, only 11 have paid dividends; of these, the majority have paid dividends either for one or two years, profit or only to preferred stockholders. Moreover, the advice said, there appears to be little prospect of appreciation in company stock values. The advice pointed out that if 510,000 shares had been invested in the Bank of Commerce and Pan American exchange stock in 1945 it would be worth only 58,810 in 1958. On the other hand, this outlook, if a corresponding amount had been placed in the New York industrial average, it would have advanced to 556,100 by 1958.

With respect to borrowing capability, the advice cited the existence of a tight money market, the high interest rates and a reluctance by lenders to extend credit to the subordinated airline industry in view of its extremely high debt-to-equity ratio. Advice said it has been the responsibility of the government to ensure the industry remains viable, that capital gains would serve an important purpose of the capital acquired for modernization and expansion of its assets fleet.

Ability to Purchase

To evaluate the effect of capital gain capture on retention upon the current ability to carry out proposed reorganization program, the CAB said, the industry should be able to obtain the stages of capital acquisition, if proceeds, replacement, depreciation and return on investment of the new airplane using Pacific Northern Airlines as the example.

In August, 1947, he said, Pacific Northern purchased a DC-4 for \$118,718, modified it for \$195,521 to bring the total cost to \$334,859. As of Sept. 30, 1978, the book value of the airplane had been written down through depreciation to \$77,907. Pacific Northern said the plane at present has an estimated market value of \$59,000. Thus, there would be a

gross capital gain of \$17,000 in a net gain of \$14,000, or 4.7% of \$334,859. The replacement of the DC-4 by a Lockheed Electra would cost \$2,350,000.

Normally, insurance companies and commercial banks will lend up to 75% of the value of the equipment to be purchased, Proffer said. On the basis, Pacific Northern would have to deposit \$387,500 in cash to consummate the purchase. If Pacific Northern were deposited in its \$174,900 net capital gain for use in a down payment, it would have to add upon the book value of the DC-4 airplane at \$77,907 and contribute the balance from earnings and/or increased capital gains by existing in prospective stockholders.

Pacific Northern said that the present amount of equity capital would be responsible since its earnings have averaged only \$60,000 a year, its dividends have been paid for one or two years, profit or only to preferred stockholders. Moreover, the advice said, there appears to be little prospect of appreciation in company stock values.

Guaranteed Loan Aid

Proffer added, however, that Pacific Northern's investment could be financed through the Government Guaranteed Loan Bill, passed by the last session of Congress. Under the bill, the government would guarantee 90% of loans or new equipment up to \$15 million. Pacific Northern would have to deposit only 10% of the cost of the airplane as a down payment.

Assuming that the books or to finance payments are willing to make loans on the basis of the guarantee, the world value the necessary down payment on the Electra to \$235,000, or a cash deficit of \$177,000—\$133,800 less \$77,907 residual value of the old DC-4.

Advice said it has been the responsibility of the government to ensure the industry remains viable, that capital gains would serve an important purpose of the capital acquired for modernization and expansion of its assets fleet. Proffer said noting that much cash might not be an unreasonable total, he asks the use of Pan American, Panjet or Bostel but that it might prove to be unworkable in the case of Pacific Northern. He said the aircraft local service carrier. This would have to resort to additional debt capital in order to obtain the necessary cash.

Advice advised, possessing a heavy debt load, the industry would be in a strong capital position to suffer a heavy loss through receipt of capital gains, he said.

Temporary Use

Therefore, Proffer added, "it would appear that, despite the existence of federal loan guarantee legislation, the capital structure of the industry would be better protected if the earnings of the airlines at the time of the sale of the capital gain for the purpose of financing down payments on the purchase of new equipment."

However, if Pacific Northern were permitted to practically return capital

gains, Proffer said, and add its net capital gain of \$14,000 to its \$77,907 DC-4 residual value and obtain the remaining \$155,900 in cash necessary to meet the down payment on the Electra, the airline would increase its return on investment from \$7,791 to \$335,000 in the first year.

The Electra would go on its books for depreciation purposes at full cost, including the recovered capital gain on the old DC-4 and at the cost of seven new PNA would have recovered \$2,350,000 less 15% residual value, a sum almost sufficient to pay off an \$1,767,100 loan plus interest without dipping into the accumulated return.

Proffer said that the economic depression following the crash of the airline on the larger investment, Proffer said the firm's assets and income would be substantially increased from the replacement transaction, assuming that return and the aircraft would be well maintained or replaced through disposals of excess not considered the merit of loan, economical and efficient management.

On the other hand, he said, the government would be paying a 10% return on the \$384,000 net residual capital gain included in the investment loan and a 10% return progressing in a proper descent of cost the same amount of capital gain on the depreciation account.

Less Capital Gain

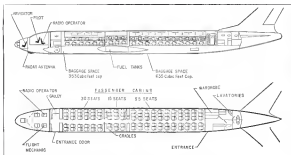
He added, that, if the Electra were carried on Pacific Northern's books for depreciation purposes, the capital gain of \$1,996,000, the current \$235,000 will increase to a return of \$199,600 the first year in loss of its present \$7,791 on the leased DC-4.

Moreover, said the Electra would provide a return on investment of 10% on the \$384,000 net residual value of \$1,996,000. In 1978, PNA would have sufficient funds to pay off an \$1,767,100 loan plus 5% in accumulated interest. The aircraft local service carrier would be expected to resort to additional debt capital in order to obtain the necessary cash.

Therefore, Proffer said, "while the government would receive a return on its investment in the capital gain in connection with the down payment on the purchase of new equipment, it does not have a gross return for permanent retention of such capital gain."

In other words, the carrier does not have a guarantee that the government would recognize the recovered capital gain as the owner airplane's depreciation account in order to cash out its program of reorganization.

Advise the carrier does not require that the government pay a return on the recovered capital gain—a profit on a profit—in order to accomplish the same purpose.



Tu-110 has high density seating arrangements and improved galleys compared to the Tu-104.

More Thrust Improves Russia's Tu-110

Moscow—Design details of Russia's new four jet transport, the Tu-110, have been revealed by the aircraft's only passenger operator, Aeroflot. The three-engine jetliner exceeds that of the Tu-104 and Tu-104A. The jetliner is 18 meters long.

The new transport has the same general appearance as the older, two-engine Tu-104, but has approximately eight feet more wing span and a four-foot longer fuselage. The most important engine change is the Tu-110 according to Aeroflot are better economy, greater range, and improved operational reliability—all achieved through increased power.

Thrust increase

Power for the Tu-110 is provided by four turbojets developed by a 30 Lada jet engine in the Tu-104 and Tu-104A. The jet is about 10% larger on the Tu-110, but only reducing an increased thrust rating.

Overcoming the thrust on virtually the same base fuselage has raised the allowable takeoff weight considerably. The new plane carries 100 passengers as compared to 50 for the original version of the Tu-104. The Tu-110 can carry payloads up to 20,455 lb which are broken down into 100 passengers, (16,000-17,600 lb), plus 5,520-4,400 lb of baggage and 4,900-6,360 lb of cargo or mail.

Power reserve is sufficient to allow

three-engine takeoffs and a rate of climb of 594-1,182 ft./min. with gear and flaps down and one engine out.

Passenger structural differences between the two engines Tu-104 and Tu-104A and the four jet Tu-110 is the manner of supporting the engines. On the Tu-110, the powerplants are tied to the spar and wing ribs of the center wing section. Engines of the Tu-104 and Tu-104A are attached to auxiliary

structure braces at the wing roots.

Carrying the engine loads on the wing has allowed a lighter and more simple fuselage construction. Eliminating direct structural contact between the engines and the fuselage has lowered the noise level in the passenger compartments.

Spur Leads

Heavy structure necessary to carry wing spar loads around the engines is not in contact of landing strappings or all three of the Tupolev turbojet transport. This is a departure from normal U.S. practice of using large brigs.

To improve the Tu-110's landing and takeoff characteristics with its higher wing loading, the flap chord was increased in general and additional flaps were added under the engine nacelles.

Passenger sections of the fuselage is divided into three zones. The first of these is situated between Rib No. 15 and the forward part of the wing center panel. It accommodates 70 percent in its area of seats each row seats two on one side of the aisle and three on the other. Each seat has a separate back, which tilts 40 deg. In one block the seats between the aisles can be across of.

The second or center cabin seats 15 percent and is located over the center wing panel.

Behind this there is the third passenger cabin for 55 passengers. Pass-



Tu-110 is one four engine version of the older two jet Tu-104 which has been in scheduled airline service around one year. An airliner has selected the flight test stage.

enger each of 21 guest capacity are provided for preparing coffee and tea.

Galley assignments on the Tu-110 represent an improvement over the facilities of the Tu-104 and Tu-104A. On the older aircraft the galleys was in the center section and basic food containers had to be carried around through the passenger compartment area. The Tu-110 galleys is located just behind the core compartment. Loading of food is done directly through a lowered door.

There are 74 standard containers in the galleys. The first row of seats is reserved to passengers are kept in areas, whereas galleys each holding about 8.5 quarts. The second corner are kept in eight containers. A heater and coffee

maker each of 21 guest capacity are provided for preparing coffee and tea. There are 112 serving trays of 14 containers. The tray takes a hot drink, two coffee, or fruit juice into a cup and pots the heated second course on a plate.

The crew cabin is separated from the galleys and the passenger area by a retractable bulkhead which is stowed on Rib No. 11, which divides the aircraft into two passenger areas.

Two washrooms, two lavatories, and a rest room are located behind the rear passenger area. The lavatories consist of a new and improved design. A 66-gal toilet containing water and a special liquid cleaned sewer and the stool in both lavatories. Water for the two wash

rooms comes from a single 21-gal tank. The wash stands drain into the same tank that serves the stools.

Behind the dining table, a neck with a double seat belt, is designed the liquid, one part of the cap is opened, connection is made with a ground circuit and then the second part is opened.

Aircraft seats that the new type seat belt and has eliminated the possibility of overflow of the individual stool, reduced the amount of padding material and simplified the replacement of the water supply and draining of waste liquid when the plane arrives at the airport.

Baggage compartments in the Tu-110 are larger than those of the

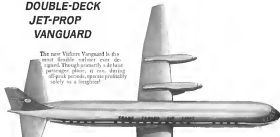


THIS PHOTOGRAPH of the Tu-110 center wing section corroborates reports that Russian designers are below Western standards. The type of engine installation with its tailings and compound curves is one of the most difficult structural construction problems. Its clearance is usually a good indicator of manufacturing skill.

A full-time
money-maker...
the new

DOUBLE-DECK JET-PROP VANGUARD

The new Vickers Vanguard is the most flexible airliner ever designed. Though primarily a deluxe passenger plane, it can, during off-peak periods, operate profitably solely as a freighter.



Smart aircraft

The Vanguard's elegant upper deck passenger cabin has all the Vickers's popular comfort advantages: knee-free passenger aisles... wide, fully-reclining seats... and, of course, the well-known jet-prop smoothness.

The Vanguard's new double deck cargo holds can carry 39 tons of payload, and an alteration in the upper deck is required to do it.

Powered by four Rolls-Royce Type jet-prop engines, the Vanguard will be capable of speeds up to 425 mph over a 2500-mile range with full payload. Its rich Vanguard will be built over 2 million flying hours of Vickers jet-prop experience, and there's no substitute for experience.



76, 46, 46, 166 passengers! The upper deck, 46 seats has good level flexibility... for extra leg room, extra wide aisles, extra room at all levels etc. There is also extra room with built-in luggage.



60 tons of freight! The Vanguard's lower deck offers a capacity of nearly 400 cu ft... can carry the class's full payload! Built for 30' wide deck, freight can be conveniently loaded and unloaded directly only.



jet-prop **VICKERS**
VANGUARD
POWERED BY FOUR ROLLS-ROYCE JET ENGINES

D. J. Robertson, Director of Sales
of Vickers (U.S.A.), New York 17, N. Y.
VICKERS AIRCRAFT CORPORATION
INTERNATIONAL AIRCRAFT A DIVISION
OF THE VICKERS GROUP

To 104 lbs was accomplished by using the floor on the passenger compartment seats 3.5 in., while lowering the floor of the baggage area 2 1/2 inches. Overall volume of the baggage compartments located beneath the floor of the forward and aft passenger cabins is 933 cu ft. Baggage is loaded into these through two side latches.

U. S. Lines Supported By Varig in Bilateral

Washington—Varig Airlines, one of Brazil's leading air carriers, is joining with American flag carriers in a dispute over fuel for a less restrictive air transport agreement between the U.S. and Brazil. Bilateral discussions between the two countries are now under way here.

Roberto M. Brito, Varig director of operations, says his airline would prefer to compete with U.S. airlines on an equal basis and therefore favors removal of restrictions against U.S. carriers. He adds that his airline has undertaken a major re-equipment program and he believes he can compete with American flag carriers for traffic between the two countries on the basis of service.

The Brazilian government, U.S. airlines claim, restricts exports and imposes other restrictions such as limiting deposit privileges, higher gas tax, air safety regulations which are unrealistic and forces excessive charges.

These are the principal points of contention during the current negotiations. Other items to be discussed between the two countries include Fifth Freedom traffic, lower fares between the U.S. and Brazil which are charged by several Brazilian airlines. REAM, which is not a member of the International Air Transport Assn and the exchange of routes.

Brasil now has three routes to the U.S. Varig flies to New York, while REAM flies from Brazil to Miami and Chicago. The third route from Brazil to New Orleans, has never been used. REAM hopes to extend its route from Miami to New York, a route which Varig will oppose along with U.S. airlines. Varig, on the other hand, wants a route from Brazil to San Francisco or Los Angeles via Mexico City and an oil field.

With Varig and U.S. airlines adopting similar stands on several matters to be discussed U.S. airline spokesmen predict, enhanced a Brazil-U.S. West Coast route for Varig is a possibility, although serious opposition might develop in moving Mexico City as an intermediate point.

Washington on the part of Brasil to force negotiations of its Brasil-New Orleans route could add weight to the exports of such a route to the West Coast, according to the spokesman.

Air Transport Assn. Challenges CAB's Airspace Control Plan

Washington—Civil Aeronautics Board's plan to control all airspace at high altitudes beginning Nov. 1 drew sharp protests last week from the airline industry.

Although the scheduled domestic carriers support the control of all airspace in principle, the airlines are objecting vigorously to certain features of the control plan and are charging that what it means is reduced capacity, waste, undue loads have been neglected. Between now and Nov. 1, the airlines will wage an extensive campaign against the plan through the Air Transport Assn in hopes of getting a serious compromise set there long.

The present plan is a CAB amendment to Civil Air Regulations and will be implemented by Civil Aeronautics Administration. It is known as an amended high altitude control plan of high altitudes and is scheduled to be introduced in two steps. First phase, to be inaugurated Nov. 1, will exclude all airspace above 24,000 ft. as a controlled area. Later, phase 2 will bring a lowering of the control floor to 15,000 ft.

Features of Plan

Here are the three chief features of the plan the airlines are protesting.

•High altitude routes above 27,000 ft. to be known as jet routes will be established. Purpose is to eliminate high altitude route system. Airlines object but feel to some extent acquiescent. Airlines want the Vortex 15,000 (high altitude) structure to extend from 15,000 ft. to above 46,000 ft.

•For instrument flight rules flight above 27,000 ft., no operations will be conducted under the CAA plan, as designated high altitude VOR, TOWER, VORTAC or LAMP facilities. The LAMP facilities previously are retained as a restriction to flying over the Air Force which are not equipped with VOR or VORTAC facilities, because of the lack of precision in LAMP navigation. The airlines want the high altitude route structure to be based primarily on VOR or VORTAC. They are willing to accept LAMP in the continental control area on a temporary basis only.

•Under the plan, colored air Vortex structure will have more than 100 miles within the continental control area from 24,000 ft. to 27,000 ft. but not including 27,000 ft. Airlines want these routes built outside the continental control area or extended to, but not into, the high altitude controlled airspace.

The CAA expects to incorporate the Vortex 1500 always system into the plan at an early date in compliance with wishes of the airlines. It is also expected that the CAB and CAB will take the necessary steps to establish a 15,000 ft. base level for the Vortex 1500 areas and expand the series to cover the additional northward and eastward routes the airlines seek. However, the airlines do not wish to accept a delay in the implementation of the plan in order to allow more time for discussion on the other two controversial items. CAB has every intention of accepting its high altitude controlled airspace program, notwithstanding the various objections.

The high altitude plan will be published in the Aeronautics Guide and by NOTAM. Claims showing the design of amended high altitude routes have been prepared by the USAF Aeronautical Center and Information Center.

Eventually, the plan calls for no change in VOR operations, and such facilities will be retained in the continental control area as the airlines know jet controlled airspace. Some lack flight rules automatic governing VOR conditions on top will apply in the continental control area regardless of altitude.

Since all airspace at high altitudes will be designated as jet, aircraft will not be required to adhere to route structure in order to access an instrument flight rule area, such aircraft will be required to fly on routes defined by high altitude instrument rules where the air traffic control coverage provided the aids are not more than 300 statute miles apart.

Compulsory Reporting

Compulsory reporting points have been established under the plan. Initially, all designated high altitude airports will provide compulsory reporting points and additional points will be established at critical intersections of routes.

Navigation aids not used for the high altitude route structure may be used for enroute and departure fixes except not served by the high altitude routes.

Flights operating below 27,000 ft. altitude but within the continental control area or above 24,000 ft. which do not follow the defined or Vortex routes, pattern must define the source of flight according to navigation aids which are not more than 300 statute miles apart. Aids selected to define the route of flight must be defined and compulsory reporting points under the plan.

Airlines Must Promote Jet Travel Before Flights Operate, SAS Says

New York—Three hundred Spanish Airlines System sales personnel from Madrid and other Spanish cities were brought here last week for a briefing on their jet age jobs.

The airlines are facing the most critical and demanding period in their careers as they try to convince the general public that the jets will give them a service of so much better than the propeller officials of the airline feared there.

Need to lead and accommodate a true mass market to fill the new jets has been a major theme of the two-day session, according to Warren E. Krocner, SAS vice president-traffic and sales.

Transition Years

If airline thinking and techniques are not drastically changed, the "bridge years" between jet and propeller, the results will be "woefully inadequate" to keep most airlines in business, Krocner told American West.

Change on the North Atlantic "has to come as quickly with the service as our own importance that we think we are in big business," Krocner said.

"We'll, we'll see. We won't be able to make it any financially unwise, and even so far as Mr. John Doe to travel in mass."

The SAS session was urged to promote jet travel as an entirely new kind of thing and to rank as the main public attention the airline believes will be found.

To this end, SAS tells people at every level in the cities visited by the Caravelle during its American tour were to take out a jet age brochure. The airline has ordered one, and ordered 10, of the French jet.

Spanish Airlines therefore has more sales people with actual jet experience than any other airline, Krocner believes.

There was one response has been completely enthusiastic, and should be a big boost in generating jet travel with the public, according to the SAS officials.

Caravelle Visits

In Europe several cities served by the airline have been visited by the Caravelle jet and all major points on the carrier's routes are expected to be covered by the end of 1958.

Spanish Airlines has something of an immediate sales position on its hands with its Caravelle flights to New York, provided by the airline in 1954 and now about to face stiff competition from Pan American and TWA. The foreign carrier recently applied to CAB

to add San Francisco as a co-terminal with Los Angeles.

"We can take anything for granted," Krocner said of the polar route competition. He feels, however, that SAS has built a reputation on the route and that it will be up to the other airlines to prove they can match the Spanish carrier's service.

The American carrier, who has expanded no station in the polar route until SAS began flying it intensively, has given SAS the strongest form of defense by insisting, Krocner said, that SAS's aircraft is a new DC-6B will be destined for only service on the polar route, Krocner said. Thus jet flights on the route will connect with domestic jet flights.

Polar Appeal

The sales appeal of the polar route is in the glare, Krocner claims, and that attention is not expected to rise with increased polar traffic. People seem only enjoy the speed of polar service, according to Krocner, and furthermore the route is fashionable.

"In Europe, you're decline if you don't serve by the polar route," he said.

Spanish Airlines has a jet age sales lead in the Caravelle, Krocner points out. "Caravelle DC-6B flights will connect with Caravelle as a basic approach, thus providing all jet age flying."

Latterly of both Caravelle and DC-6B will look over from the "airline crash" philosophy of the past, Krocner said. Some companies at flight time are not expected to sell as well as flight time will be part of SAS's jet age effort, Krocner said. This will be limited to that one type of flying.

Major seasonal shifts in the package tour area will be made by SAS, according to the official.

An SAS pilot he led, in a 21-day European tour under 5700.

The airline will begin its pilot-to-pilot tour a day or two before the customer market by his own mission.

Spanish Airlines' overseas office sales department in New York can put each jet flight, in 14 hours, with the help of voluntary data processing, Krocner said, whereas three weeks through was required.

The new department group 51 million during its first year, is expected to take a 10% increase, he said.

Krocner sees the pilot-to-pilot program as aimed toward packaging the world's cities into appealing theme. Caravelle can also attract the merchandise

they want and get it at lowest prices. Spanish Airlines' insurance was told at this meeting that the question of insuring the jets, which the jet age will depend will get additional private toward "airline valuation," the passenger. This fund over from guaranteed service of ticket counter, lounge counter and other. It must be overcome despite increased traffic, Krocner said, because such service is one of air transportation's main selling points.

Rep. Harris Challenges Report by Celler Group

Washington—Report by the House Aviation Subcommittee charging an "excessive" competition in air transportation has been challenged as "unsubstantiated" and "a great disservice to the industry" by Rep. Glenn Harris (D-Ark.), chairman of the House Commerce Committee.

The subcommittee group headed by Rep. Emanuel Celler (D-N.Y.) has urged the Justice Department to investigate the Air Transport Act for possible monopolistic patterns and the Civil Aeronautics Board to make "a general investigation into all of Pan American World Airways' activities (AW) Sept. 2, p. 11.

The subcommittee also recommended that the policies of the 1938 Civil Aeronautics Administration Act be changed from "competition to be the extent necessary" to "competition to be the extent necessary."

Harris objected that the Celler report failed to recognize that competition is only one of several public entry factors before the CAB seek weight in its decision.

"The report," he said, "implies that absence of competition, concentration of routes, establishment of uniform standards under CAB approval and other factors are sufficient to justify monopolistic status. These are not the factors which should be considered by the CAB."

"This represents a superficial concern with only one criterion of public interest."

Harris defended the 1938 act as "adequately covering" the requirements for competition and proof that Congress intended competition as one of other concern factors.

Harris said there is "a basic one-sidedness reflected throughout the entire (Celler) report" in the case of Pan American, he objected, "accepted as a fact a variety of services made in competition with PAA by other airlines."

Harris said that the subcommittee in PAA testimony, to give the airline "the adequate treatment" that it is an over-representable business category or private citizens should receive.

Iberia Fills Piston Needs, Looks to Jets

By L. L. Doty

Madrid—Iberia Air Lines of Spain has completed its post-war re-equipment program and will withdraw its further expansion of routes and its new jets into the largest field.

The airline has scheduled a five-day tour to add turboprop transports to its present fleet as a necessary step in retaining its competitive stand in the North Atlantic market, but it has not withdrawn on the route service has been maintained to its needs. Most Iberia equipment is Boeing's 707 (AW July 29, p. 45). Meanwhile, the airline has doubled its service between Madrid and New York and added modern equipment to its South American activities at the head of an improved transatlantic maintenance program and the purchase of two Lockheed Constellation 1049Cs earlier this summer.

A total of five 1049Cs, three of which are converted 1049Bs, operate on the Madrid-Caracas route. Two Constellation 440s serve the carrier's extensive European and intra-Spanish routes. A fleet of six DC-6s, 17 DC-3s and 4 B-24D 470s complete Iberia's fleet.

Constellation Maintenance

Constellation maintenance is performed at New York International (Midway) Airport under contract with Lockheed Aircraft Service-International (LASI).

The maintenance program, involving maintenance inspections, overhaul and component replacement, is scheduled to permit two-manual of aircraft within an eight-hour period. The airline is forecasting its major traffic development effort on the Madrid-New York market but has no current plan for extending this route. The airline, however, expects to expand its Madrid-Puerto Rico-Caracas route (Iberia) and is studying possibilities of a bilateral agreement by the Colombian government to authorize this service.

Passenger Expansion

In view of its 41,000 miles of routes including a route from Madrid and Valencia to Rio de Janeiro, Caracas and the central West Africa coast, an additional expansion of Iberia's routes would put it among the operating capacity of the carrier's fleet. However, Iberia is negotiating a substantial increase in traffic on its present routes to 1957 over last year with the seats it now operates.

Indications are that the airline will post the one million mark in passenger count during 1957. This compares with 671,345 handled in 1956. Last year, Iberia had a net profit of approximately \$568,000 (U. S.) at which \$158



1049C and Lockheed 1049C is delivered to Iberia Airlines. Five seats 63

orders additional revenue through charter service or extra seating.

Engine overhaul time has been cut to 100 hours and airframe overhaul is performed every 12,000 hours. Iberia maintains a staff of five technicians at the LASI installation, one of whom serves as a permanent base representative for the carrier. The remaining three staffers are fielded by mechanics from Spain on a rotating basis.

Maintenance on all other aircraft is handled at the company's base base at Iberia Airport in Madrid. Any emergency on-line maintenance is covered by sending teams of mechanics and technicians to the trouble base. However, all engineering and technical personnel at Madrid are Spanish.

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Two other airlines were organized in 1928 but in 1927, all three carriers were merged into one organization known as Iberia, Iberia, Iberia, Iberia.

In 1912, the airline was nationalized by the Spanish government. It operated domestic routes as well as a route to Lisbon with Ford monoplanes and Douglas DC-2s until the Spanish Civil War began.

Thomas Delgado is president of the airline and Gen. Gonzalo Lanza is general manager for the U. S. The airline's main office is in New York, Washington, Philadelphia, San Francisco and Chicago in the U. S. and operates a loaded worldwide route. The airline is now in New York for handling passenger baggage shipments.

600, or 7% of capacity, was distributed as additional. The balance was withheld in the company as reserve. All through the airline is international, it is state-controlled and owned.

In 1916, the airline operated 36,774 flights and flew 9,910,000 miles. It handled 1,191 tons of freight, 870 tons of mail and flew 251 million passengers.

The airline has 2,447 employees, 75 pilots and co-pilots and an another 100 crew of 165 members, including cabin attendants, navigators and stewardesses. Iberia flies its own airline.

Iberia Air Lines was established by government decree in 1940 after the Spanish Civil War had brought all airline operations to a halt in 1936. World War II prevented full development of the airline, and it was not until 1947 that it opened its transatlantic routes to South America. Service to New York from Madrid began in 1954.

First airline service in Spain was established in 1911 by being an alliance between Madrid and Spanish Airways. Two other airlines were organized in 1928 but in 1927, all three carriers were merged into one organization known as Iberia, Iberia, Iberia.

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SHORTLINES

■ **Sabena Belgian World Airlines** will add three new stopping points to its existing network with the introduction of the airline's winter schedule on Oct. 6. Montreal will become a twice weekly stopping place on the Brussels-New York line. Atlanta will be served once a week from Brussels via Frankfurt and Athens, and Belgrade will be served twice weekly direct from Brussels. Transatlantic services to New York from Brussels will be reduced from 11 to nine flights a week.

■ **Federated Airlines Inc.** will begin its 8,674-822 revenue passenger miles in August for a new comparison. The passenger load factor for August was 61.54 as compared with 52.91 in 1956. During the first eight months of 1957, Federated carried 293,666 passengers for a 7.44% gain over the same period of last year.

■ **United Air Lines** shows a world record in revenue passenger miles in one month by flying 518,900,000 revenue passenger miles during August. The figure represents a 15% gain over the same month last year. In rounding the record, United operated its fleet of 135 airplanes a total of nearly 1,000 trips daily during August.

■ **American Airlines** carried 775,000 passengers more than 482 million revenue passenger miles during August. This was compared with 704,000 passengers and 456,740,000 revenue passenger miles for August last year. Arrivals for the month were 7,065,000 ton-miles against 7,014,000 during the same period last year.

■ **Elkington Airlines** registered a net profit of \$318,000 during 1957 according to a report recently released to stockholders. Operating revenues in 1956 were \$4,740,000, operating expenses amounted to \$3,911,000. The airline flew 734,000 passengers approximately 51.5 million ton-miles passenger-miles during the year. Elkington Airline has a terminal and operates in Times World Airport.

■ **EasyJet Air Flight** is going after St. Lawrence Seaway construction shipyards with a new service especially designed for contractors on the project. The freight forwarder has set up two units involving direct service to Buffalo for shipments over 200 lb., and to Syracuse for shipments up to that weight. Transfers from these points are made to Montreal as the delivery point via specially arranged overnight trucking service, EasyJet reports.

AIRLINE OBSERVER

■ Look for a decrease in military travel on commercial airlines due to cut-backs in defense spending. A downward trend already has been noticed, but the full impact of reduced spending will not be felt until early next year. Defense Department transportation section says travel has not been greatly reduced in 54 but adds it is logical to expect a cut. However, at least 100 cargo airlines have experienced a sharp drop in military travel during the past 10 days. Joint Airline Military Detail Office (JAMDO) of 65 military bases report that military travel recently averaged \$3.5 million monthly before the decline.

■ **International Air Transport Assn.** traffic conference opened last week with the problem of introducing the proposed third class fare on North Atlantic routes in April in the near future. Although most carriers are unenthusiastic over the prospects of any further rate cut, the majority of IATA members are now accepting the proposed low fares as an inevitable fact. Chief problems in the meeting of the Miami conference are adopting the third-class rates, ensuring seating density and the quality and quantity of in-flight service that will be provided on non-scheduled passages.

■ **Supplemental airlines** have virtually dropped their services for individuals-traveled passengers on flights between New York, Washington, Chicago and the West Coast and Florida. The "regular" regular service now uses an active element of transport operations in New York, Chicago and Washington—particularly when the new defense Times American Airlines was in the north—but has disappeared entirely from the Washington airport since in New York and Chicago, non-scheduled flights are rapidly declining to an inconspicuous figure. About 90% of supplemental airline activity is now confined to military commercial air movements and other charter flight operations.

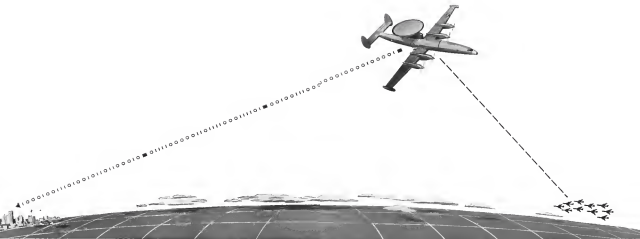
■ **Fokker** will send a Friendship F-27 turboprop transport to Brazil later this year for demonstration flights in part of its overall sales campaign. Fairchild is also conducting an intensive sales campaign in South America. Under its sales and manufacturing contract with the Dutch firm, Fairchild is free to sell the F-27 in every North and South American country except Brazil.

■ **Capital Airlines** has appointed the New York advertising agency of Kavan and Belknap to handle its account beginning October 1. The airline is scheduled to launch its service between New York and Washington after more than 10 years of association with the Washington line because it wanted an agency with branch offices throughout the Capital system. Capital's annual advertising budget will be approximately \$3 million in 1958.

■ **San Francisco's Public Utilities Commission** has awarded a \$17,500 contract to the aviation engineering firm of Leroy Fokker for advice on how to spend the \$25 million airport bond issue approved by voters last December. The North Bay, Ind. firm will take about a year to work out recommendations for construction projects in extending and improving the San Francisco Airport.

■ **Prepared for its market** to handle Rolls-Royce Dart turboprop engines under a pooling arrangement between East West Coast purchasers of the Friendship F-27 has been defined pending the month of a series to be undertaken by an independent consultant. The low altitude-West Coast, Business, Northern Consolidated and West Alaska will issue a cooperation to operate the line if an agreement on the plan is reached. Contracts do not expect to be in a position to discuss details of the proposal for at least another six months.

■ **Delta Air Lines** will introduce an expanded cargo program that is scheduled to increase its all-cargo service by 100% with a fleet of five C-84D cargo aircraft leased from Civil Transport Company (CTC). The airline hopes to produce 21 million ton-miles of air freight during the first year of the operation which begins Oct. 1.



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ENGLISH Electric P. 1B, now flying at speeds approaching 3,200 mph., compares favorably with U.S. military designs.

P. 1B Combines Maneuverability, Speed

By David Auerbach

Worton, England—English Electric's P. 1B is currently flying at speeds approaching 3,200 mph. and achieving its performance parity as Britain's first truly supersonic military aircraft.

Most impressive of the airplane's development is how through this new P. 1B comes an outstanding low-level and high-altitude maneuverability coupled with supersonic flight performance

from about 1,000 ft. up to its ceiling, which is currently limited by powerplant rather than by aerodynamic considerations.

It is the fact of the past few generations of military airplanes designed here that can be compared to only one or two of performance with its contemporaries in the United States.

It was conceived in a research airplane, but evolved rapidly through a proposed day fighter to its present role

as a replacement of another interceptor weapon system.

It is now in production here under a few initial sale of buildup similar to the USAF Const. Change plan. Twenty-five production aircraft are being built on production tooling to make available a large volume of flight and systems experience before the mass stream of production is based on.

The requirement for the P. 1B visualizes the plane as an integral part of a weapon system, with the purpose of long-range interception under all weather conditions. Long range, low altitude is required by British stand order, not by American or Canadian.

External Stores

The airplane serves in this system as the weapons carrier and for this reason can be fitted with a large variety of external stores. One normal armament arrangement is a pair of 30 mm. Aden cannon in the fuselage. The de Havilland Freedom infrared homing missile was developed for this airplane and although it has not yet been officially matched to it, has been certified and fired from a ground rig simulating the P. 1.

With the power available, the P. 1 can boast of undocking fuel tanks, rockets, missiles or bombs. It could carry



P. 1A prototype takes off for flight demonstration at Farnborough.

AERONAUTICAL ENGINEERING



NOSE SPIKE on P. 1B generates low shock for supersonic intake. Circular inlet replaces oval shape on P. 1A.

a bench underneath the fuselage on a corner rack for photo-commissioner.

The landing slipper tank which has been down on the airplane, could be either cyclic fuel, or a complete Napier Double Scorpion inlet pack in reaction thrust is another 4,000 lb. for altitude performance.

Complete airborne inlet, working with ground controller for initial vectoring, is installed on the P. 1B.

Flight Profile

Flight profile is the usual for an intercepter: short takeoff, rapid acceleration and climb to altitude, one or two passes of the target and home again.

Enhancement is about half an hour, which is probably representative of a typical mission.

The P. 1 series is built around the throat of a pair of turbojets, mounted so that their inlets are parallel to an over-and-under configuration. Engines are staggered fore and aft so that the inlet of the upper is almost directly above the inlet cone of the lower.

The airplane's fuselage features a highly swept wing set a little above the combined throat line and a club tail set well below it. Wing leading edge sweep is 60 deg. The vertical tail is a delta surface.

Wing span of the P. 1 is about 36

ft. and the overall length is about 52 ft.

Aerobically the P. 1 is the most sophisticated and the most thoroughly developed configuration yet flown in England.

Calculated first, the basic geometry was developed to its current form by wind tunnel tests in the company's low-speed and transonic facilities, by rocket-powered model tests, by low-speed evaluation of an automatically swivel, full scale research airplane and finally through flight tests of the prototype P. 1A.

It is a tribute to the engineering of the whole design that these have been no basic layout changes in the series



P. 1B has small, nose overbalanced canopy than P. 1A. Other changes include spine down back, spine difference in tail and exhaust.





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5 basic factors behind the earth satellite launching system [PROJECT VANGUARD]



HOAG stood down at F. 15. Loading goes also is higher.

object that these debated by the requirements.
Design team of the F. 1 was originally under W. E. W. Pette, who left English Electric by mutual agreement in 1950 to work on the Constellation lighter weight. The project was taken over by R. W. Page, chief engineer of the aircraft division of English Electric.

Area Distribution
Best reason for the extensive cooperation of the F. 1 team was the application of the NACA's area rule principle. Wing area of the airplane was determined as it is on most designs, by the combination of altitude and loading performance comparison with speed consideration. Once a wing area was fixed by the specification, the best way to distribute it along the fuselage is in the simplest, most practical manner.

In some cases this has been done with a delta surface as in the Convair F-102-156 series. But English Electric engineers decided to use a more conventional wing of slight taper but at extreme sweepback.

Area distribution of this highly swept surface adds a big and easy save natural way to the basic plot of total airplane cross-sections.
With wing sweep and area fixed, tail area could be calculated. The F. 1 project team, aware of many of the stability and control problems encountered in England and the U. S., ruled out an flying but a delta tail, based on the fuselage to avoid the pitching problems frequently encountered with even high tail.

Wind Tunnel Tests
The basic aerodynamic configuration of the airplane was developed by continuous wind tunnel tests in English

Electric and other British facilities to the final layout that appeared on the F. 1A. The company had been operating a low-speed tunnel for some years previous to the design of the fighter. Early in its design stages, they were able to start operating a transonic tunnel of their own with slotted throat and a test section large enough to do the multiple of model work needed in the wind-tunnel verification of the design.

There was another set of rapid data available to English Electric from the flight testing of a research aircraft, the Short SB. 5. This airplane, contracted for by the Ministry of Supply, was intended to give low speed data, particularly handling characteristics, of the odd layout. The short design was built to take a series of wing of different sweepback and had both smooth and light metal surfaces, plus a variety of other special gear to contribute to the development program.

The SB. 5 test flies in December 1952 and a rapid assessment of the results was made that by that time the configuration of the F. 1A must have been fixed, for better or worse. All that the SB. 5 would do was to confirm English Electric's choice of the geometry of the airplane.

Extreme sweep areas, other aerodynamic problems, such as tip stall and the resultant loss of aileron control. Normal ailerons, with sweep like that of the wing, were obviously out for such a high degree of sweep. Spinnaker flaps would all but make them useless. Flexible tip ailerons, similar to the type used on the Boeing model, were also designed and abandoned.

Final configuration of the ailerons was based on ailerons normal to the camberline of the airfoil. The horn balances, selected to give maximum effectiveness, have proven satisfactory and will be dropped in the production airplane.

Power Control
Wing loads resulting from aileron deflection on the F. 1 are primarily bending in the chordwise plane, rather than the combined spanwise bending and torsion experienced with most usual aileron layouts. This reduces the structural weight. But aerodynamicists were worried about the possibility of wing air mass flutter with the proposed power control system, they went to a completely inextendible power boost system on all the surfaces of the airplane.

Control surfaces, now being flown experimentally on one of the F. 1A prototypes, is another of the aerodynamic features of the design. The basic wing did not have it, but data available from NACA's own other aircraft, showed the advantages. An extended leading edge, which gives a cranked

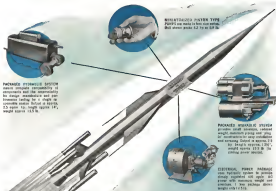
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appearance to the P-1A was built and is currently being evaluated in flight testing following extensive ground tests.

The success in the leading edge of the P-1 wing is probably the highlight of the current crop of vortex generators appearing on many British and major U.S. military aircraft. It was developed from wind tunnel tests and originally was a slit about four inches wide cut in the leading edge, just as if it had been done with a large saw. Since its original appearance, the spanwise width of the slit has been reduced by about half. In addition to creating the high-energy vortices that re-energize the boundary layer on the outboard portion of the wing, the slit—which has a tiny rim or flap in its leading edge—prevents the flow from stalling on the plane.

A saw flap at the inboard wing root was tried during the early flight development of the P-1. The intention was to help prevent stallstrip at the wall in case it developed. It didn't. But the normal job of stalling was reduced somewhat by this root flap which wasn't expected. Apparently the complex flow field pattern is influenced by conditions which start at the wing root and which spread spanwise. Eventually the manufacturers decided that the root and inboard flap was not so important to justify staying on the airplane, and it was removed.

Altitudes Added

The P-1A was designed around Armstrong Siddeley turbojets rated at about 7,500 lb thrust. Originally these engines did not have turbochargers. The first prototype was later fitted with turbocharging capacity to bring the thrust up to about 10,000 lbs per engine. The plan was to use the September flight through the program. Later Siddeley failed to appear and English Electric changed to Rolls-Royce Avon, being some three years late.

The P-1B is now being with a pair of RA 25R Avons rated at 11,250 lb each without turbocharging.

The P-1A designer began with a perforated simple pitot inlet leading to a ducting that passed straight beneath the pitot and into the fuselage. The shape of the inlet was modified because of the penetrating radar intended for the upper lip position on the fighter version of the plane.

The canopy was revised and flat and swept back with the top deck line of the fuselage. From there on up, the branch of the engine deflected ductage side and shape.

The improved thrusting ratio of the P-1B plus the need to have some radar in some position led to the adoption of the circular single shock inlet with center body. At the same time,

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the post-flighters forced other changes in fuselage details.

Experience with the earlier engine defined a change in a main structural one on the P-18. The canopy is now jacked for better visibility, and, in the drag shadow of the canopy, a dual spar has grown to carry most of the systems forward, threaded through the fuselage under the skin.

Canopy troubles plagued the early flight tests of the machines. Both Beaman and De Villiers had their blow off. De Villiers had his go at supersonic speed and apart from "one bit of a bang" nothing serious happened. The canopy had been locked down in a simple toggle that was supposed to do the job. Under no load and pre-rotation, things disintegrated just enough to unlock the lock. This error has been fixed with lock redesign.

Viewpoint Changes

A 1947 Ministry of Supply specification looked all the P-1 series designs. It was belated recognition by British officials that sustained supersonic flight was not extremely dangerous if the designers and pilots knew what they were doing. Before the little Bell X-1 drove the point forcibly home as it passed the English sound barrier, the official British view—expressed in more engineering advice—was that the danger of sustained supersonic flight was too great. Therefore would tests over the rich areas, they had authorized, in 1945, ranging at least one practicing supersonic research airplane in the field.

A handful of engineering firms—Aerovox, Whitworth, English Electric and Fines among them—were delighted at the second thoughts of the Ministry and advanced designs about two years later after the specification was issued. The English Electric proposal became the P-1 and P-10's layout took tangible shape as the Delta 2. Both schemes were bought by the Ministry and the work began on two design concepts.

First substance on the design of the P-1 was the acknowledged experience of the U.S. in the supersonic flight regime. Background: the Bell X-1's stream of flight tests, coupled with training experience as the F-56 Sabre, convinced the English Electric aerodynamicists that there was no point in going back over well-trodden ground. They drew heavily on American results, on NACA reports, on Beaman's insurance flight experience with the F-56. Then they concluded that it seemed pretty safe to develop just another supersonic research aircraft to duplicate in large measure what was already accomplished and integrated into design in the United States.

The recognition of earlier experience defined the project team as its basic

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Aviation, Inc.



Javelin Design Changes

Oliver Jevtic, seated with the Cleveland Fuselage as test data of bombing mission, has vortex generation on wing, blunt trailing edges. Tailplanes have been lengthened, opened off.

approach a supersonic aircraft engine that could be used with the addition of the necessary systems—a supersonic fighter engine.

But the official view from this was that the days of the manned fighter were numbered, and that new turbo-propulsion for the concept of a super supersonic fighter machine. English Electric produced its final design for the P. 1A as a research plane with developing capability.

It took about four years to afford data to accept the fact that missiles get more than around the corner. In one of its remaining years of life, many of the aircraft industry, the Ministry began to think about research in supersonic fighters by old-fashioned means.

By now the known risk exposure had sunk in and, among other points, had emphasized the importance of total risk for the pilot flying in instrument combat. Radar for day fighters was one of the answers, and the incorporation of that into the P. 1 began somewhere along the line, the designers thought that a little extra space and weight could make it a supersonic aircraft.

That's basically how the P. 1B evolved.

First prototype P. 1A lifted off the runway at Boscombe Down on Aug. 4, 1954, with Roland H. Bomson, English Electric's chief of flight operations, at the controls. The second prototype flew a little less than a year

later in July 1955. Both prototypes have since logged more than 600 flights and have been extremely useful in developing the B series.

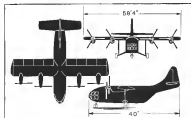
A third prototype, built as a structural testbed only, was tested in the structural development.

First of the development batch of P. 1Bs flew April 4 this year and since then has been joined by a second B

that is now also on flight status.

Program for the series, estimated, in addition to the three P. 1 aircraft listed above, three prototype P. 1B aircraft and a production batch of 28 planes.

Production tooling was to be used throughout, even for prototype manufacturing, and the life was to start with a slow initial rate of build up. This scheme, finally accepted after



Breguet 940 Is Short-Field Plane

Propaganda "language" requires less than 100 ft. of runway, is designed for equipped field operations. First test shows wing principle, the entire wing being placed on the apex of the propeller.

produce a large number of airplanes early for example, various experiments and stress testing before the major portion of the aircraft program was completed.

Major reason for this was the Swift fuselage, which might have never happened had a smaller production plant been used.

Third Prototype

The third prototype P. 1B should be seeing the end of its experimental phase in now and conceivably the aircraft could see the flight test work along about the beginning of the forthcoming year.

The airplane already has been flown in experimental test and service plan of the Royal Air Force, as well as by Bomson and the company's chief experimental test pilot, Desmond De Vries.

Final production airplanes should start reaching the RAF in another year, so that first-line squadrons of the P. 1B could be operational as the middle of 1959.

See Long Life

Service life of the airplane could be a long one with the airplane program through its acceptance. In possible roles as a ground support aircraft, type or and as the aircraft carrier begins to shoulder one of the P. 1's main roles.

There is much optimism for the airplane outside the company. First mission of the RAF has been concerning to the engineers who stand in the design.

Today, there are advanced versions of the P. 1 being carried through design stages in the fact that the aircraft is not for a very long time, going to take over completely from the current interceptor.

Test 180-deg. Camera in Grumman F9F-8P

Historic-to-be aerial photograph of Long Island taken by a new lightweight Perkin-Elmer wide angle camera which appeared at MANHATTAN WALK Sept. 15, 1954 was taken from a Grumman F9F-8P.

Plane was flying at altitude of 7,000 ft. and air speed of approximately 350 kt. which is the optimum photographic speed for the periscopic camera at that altitude.

Chief of the plane during this first mission for the new camera was Lt. Cmdr John P. Condon. He is Deputy Director of the Aeronautical Photographic Experimental Laboratory, Naval Air Development Command, Johnsville, Pa., which is conducting flight testing of the camera.

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FOR THE GRANGE FOUQUET C85A

A support fitting for a jet engine removal truck, CAST BY LEBANON is precipitation hardened stainless steel for close tolerances, dimensional accuracy and surface smoothness required by the design. A significant example of how Lebanon Foundry engineers were able to successfully produce a casting which substantially retained the original dimensions of a machined part, at a lower cost weight.



FOR A ROCKET TEST UNNAMER

A nozzle ring for a prototype rocket engine by Reaction Motors, Inc., CAST BY LEBANON is stainless steel. Representing the ultimate in casting design and production, the casting requires elaborate accuracy of core placement, close tolerances, and thin material sections. These exacting requirements forebode the foundry techniques of the future, now being employed at Lebanon today.



DESIGN AND PRODUCTION ENGINEERS: If you would like one of our brochures of these castings, together with the manufacturing data, process development and applications to your design program, write to Lebanon and ASK FOR DESIGN FILE P.



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Bell Tests H-40 Drive for Durability

By Craig Lewis

Fort Worth, Texas—Bell Helicopter Corp. is currently testing a drive system for the H-40 turbine-governed helicopter which is designed to give the H-40 a 1,000-hour life between overhauls.

Transmission and the rest of the drive system on the H-40 were designed for durability and long life, and the system is going through an extensive test program to prove that it is a reliable 1,000-hour overhaul item.

Tests on the H-40 drive system are part of an overall test program on the new utility helicopter Bell has designed for the Army. Bell expects the program to prove the H-40 represents a breakthrough in operating cost, maintainability, reliability and performance. Bell says its new helicopter will be the first to offer 1,000-hour overhaul periods.

Drive System Test

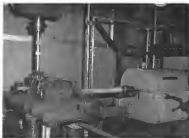
While the XH-40 prototypes are going through their flight test program, Bell is bench testing the helicopter's drive system in a rig which simulates turbine-governed and light conditions. The X phase of the testing has been completed after 618 hours. In the Y phase, Bell will run the drive system through 1,800 hours of testing to prove that the original design, plus some changes developed from X phase test work, represent a 1,000-hour system.

The transmission and drive system for the H-40 were designed specifically for ease of maintenance and speed of removal and replacement. Designers used actual three-dimensional views in developing the system. Sketches were an essential consideration, and Bell says engineers have used the same parts throughout the entire helicopter assembly.

Vendor's bearings offer one example of simplicity. One bearing can be used in 11 places, provide simple, repeatable problems in maintenance. The main drive shaft has five sections, all interchangeable. Shift is achieved by Mustang-type clamps for ease of dismantling, and the engine-transmission drive shaft is also secured by this type of clamp.

Bell engineers designed the transmission and output with the least number of different parts possible. They also tried to avoid the need for special tools for maintenance. Whenever possible, they determined what tools would be available to the crew which would maintain the H-40, thus designed a system to be handled with these tools, plus a minimum of special tools.

Another feature of the transmission that lends itself to easy field maintenance



H-40 transmission test rig shows transmission (left) rest, speed-up gear box (left front) and final coupling (right). Vertical shaft goes to dynamometer overhead.

is a simple exchange of bevel gears. A level gear shaft can be applied to the transmission with no shoring or support, eliminating the complicated problems required in former helicopter transmissions.

Such maintenance problems are amplified by the fact that the oil level is both the transmission and the two gear boxes in the tail rotor drive system can be checked by sight glass.

Since the H-40 is powered by the Lycoming T-53 free turbine engine, Bell was able to simplify its output and use a short T-53, by decreasing the clutch torque by means of a transmission output. Transmission reduces the T-53's speed of approximately 6,000 rpm to about 26:1 through bevel gears and a two-stage planetary system.

Test Facility

Bell is proving out its drive system design on a test rig located in a Navy-owned facility at the engineer's Fort Worth plant. Facility is built to accommodate single rotor systems up to 2,000 hp and dual rotor systems up to 5,000 hp.

Power for the test facility comes from a 2,000 hp power package taken from an F-104 helicopter engine in a Pratt & Whitney R2800 Mustang engine power plant in the test cycle in the 500 hp specified for the T-53.

To simulate a turbine-type power flow, the R2800 engine is hooked to a fixed final coupling and a speed-up gear box. Final coupling mimics torque as taken from the main engine, simulat-

ing the smooth torque delivery of the T-53. Thus the gear box, which is a modified HSL-1 jetted transmission, stresses coupling output speed much more to one.

Simulated turbine power is delivered to the H-40 transmission and through the drive system to dynamometer which simulates main rotor and tail rotor loads. A Clifton water brake dynamometer provides tail rotor load, and water meter load is provided by a G.E. horizontal type induction dynamometer.

Simulate Abuse/Rotation

A right angle gear box is used to transmit power from the main rotor shaft to the dynamometer. A 50 hp electric motor is connected to the shaft with a chain drive to simulate interaction and free wheeling test occurrence. The H-40 drive system is equipped with a free wheeling clutch to permit into rotation.

While the drive system is undergoing bench tests, the three XH-40 helicopters are also developing data on the ground in flight tests. The first that bench testing of the drive system began six months before flight test has been important in keeping the whole program moving along. Charles W. Bowers, Jr., Bell manager supervising the bench test, says the transmission program has managed to stay ahead of flight testing and "there has been no drop in time for lack of transmission knowledge."

Testing of the Y configuration drive system is scheduled for completion at

for more than seven testing of the Y11-60 is finished so when the production H-40 is ready, Bell can assure the Army of a 1,000-hour overhaul item.

Turns as far have developed as configuration changes in the transmission or drive system, but several major changes have been indicated in the debugging program. Finally, lubrication overhaul must only bearing lubrication before

the system was modified to correct this and other problems.

Bell will switch to a separate 4-bar system using two transmissions back to back with a low horsepower motor for spot checking and removing production transmissions. This is cheaper and easier than moving transmissions to one or two corners in close with the piston-powered HSL.

Highly Precise Hydraulic System Alters British Windtunnel Nozzle

London-Britania 8-ft. supersonic windtunnel at the Royal Aircraft Establishment, Bedford, has a number of unique design and control features not yet found in any U. S. tunnel.

The 532-million tunnel is designed to cover subsonic and supersonic speeds up to Mach 2.5, with air pressure from 0.1 to 8 atmospheres absolute. It is an 530-ft.-long closed-circuit structure.

Variable Nozzle

Its infinitely variable nozzle is formed by flexible plates, one in, thick, 62-in. long and 6-in. wide, located at the top and bottom of the working section.

These plates can be controlled by a system of hydraulically-actuated, temperature-controlled stress joints.

Each of the plates is carried on 30 pairs of these 30-ton mechanical jacks, each pair driven by a separate 5-hp rotary hydraulic motor.

Precise Control

Operated through a master tape, the jets can be simultaneously moved in increments of either 11 or 34 thousandths of an inch to flex the plate into any desired nozzle profile while the tunnel is in operation. To effect this degree of precision, a hydraulic amplifier valve was developed that is sensitive to

a mechanical input motion of 0.0005 in.

The system believes this valve will prove of considerable importance in automatic control systems generally.

Like other tunnels of this type, the subsonic flow is controlled by varying the compressor speed while supersonic flow is developed and regulated by the shaping of the working section nozzle. To fine-tune the airflow down over the model to subsonic speed for reentry to the compressor, a diffuser section of the same physical size as the working section nozzle is required.

Special control systems are provided at the Bedford tunnel to shape the nozzle and diffuser, control the compressor speed and control the movement of the nozzle in nozzle model.

In order to provide shoulder and uniform flow past the model, the curvature of the walls in the working section has to be accurate to within 0.005 in. between each jacking. This requires precise control of each jacking station throughout the speed range of the tunnel, while the mechanisms used are capable of being made while the tunnel is sealed and the compressor running. In the diffuser, accuracy of control is not so critical, only 0.050 in., and the design takes the form of movable



Freighter-coach Model

Assembling Wharfedale AW 481 passenger/freighter design is shown in model form above. The medium-sized "freighter-coach" will be turbo-prop-powered. Two prototypes of the aircraft are under construction and several others are laid to be delivered.

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ENGINEERS — GPL technicians have spent six years perfecting research and development opportunities. Don't remain in Personnel Manager's

push on either side of the tunnel with adjustable air inlet doors providing a bypass circuit.

The hydraulic amplifier valve is of the piston type, is of simple construction and has extraordinary sensitivity.

Features are incorporated for the control of both frequency and amplitude of either the sensitive valve and for speed response in the main directional valve.

Rig testing showed that changes in

load temperature in the vicinity of the sensitive valve of only a few degrees could be made to shift the main hydraulic valve on load. This sensitivity was desired for stability reasons.

The jets and reduction gears are mounted in transverse pairs, together with the driving motor and main directional valves, on subvertical platforms, which permit an inspection on the main runway and allow the jets to swing when the various orifice profiles are being flown.

The plate thickness was maintained to better than 0.002 in. Nasa's profiles can be formed to within 0.001 in. of the theoretical shape required and slopes between angles are kept to better than 1:1000.

The whole of the working section weighs 450 tons and is supported at three points. The downstream point is fixed and the other two are roller supports.

Main compressor of the tunnel is the largest in Europe. It is a 18 stage axial machine driven by a 68,000-hp. 6-pole synchronous motor connected through a gearbox to two 8,000-hp de pony motors connected in tandem.

Three methods of operation are possible:

- For subsonic work on reduced loads, the compressor can be driven by the 12,000-hp. motor alone, with the 68,000-hp. machine disconnected, providing a total stage of 150,770 rpm.
- For high power, the 68,000-hp. can be run at a fixed speed of 710 rpm, drawing its supply from the external grid system with the dc motor contributing 12,000 hp.
- The full power variable speed working, the main 68,000-hp. motor is driven from a variable frequency supply from 10c/3-50c; generated by two 26-mva. gas turbine generating sets.



Retodyne Rotor Details

Rotor and hub (above) for Finlay Retodyne, now being completed at company's plant (below), shows the ducts for the passage of air flow. An issue for Super Elund turbo-shaft engines, which also drive the forward section propellers, is supplied to the four hollow helicopter blades where it is burned to tip jets for vertical flight.

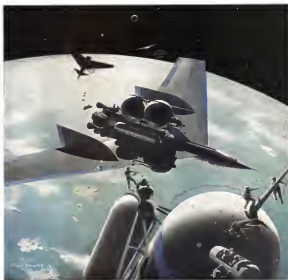


Illustration by Charles Beaudou (from *Life*), L. A. P. (Illustration of Mars), H. G. Wells (Illustration of Venus and Earth), H. G. Wells (Illustration of Saturn and Uranus), and H. G. Wells (Illustration of Jupiter).

How do you control temperature on space ships?

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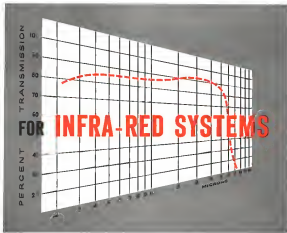


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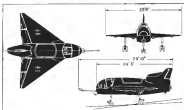
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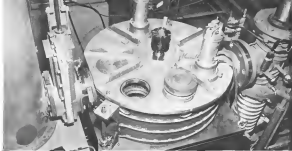
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Short SC.1 VTOL Uses 5 Jet Engines

Short SC.1 VTOL, stretch aircraft is powered by five Rolls-Royce RB 108 high thrust weight ratio jet engines. Three are at right down three engines are under just ahead of the vertical tail. Forward flight tests have been completed and the aircraft will soon begin hovering tests with safety cables attached to a posty (lower right) in case of a mishap. The SC.1 is standing before a large fan in the lower left photo during a canopy fit-testing test.





WIDE VARIETY of high temperature components suitable for operation at 500C or higher can be produced by vacuum-evaporation process which opens way to using many new materials. Facility shown is designed for non-oxidizable metal-film production.

New Techniques, Materials for 500C Components

Surprising Development

Activity of Servomechanisms, Inc. in the field of basic component technology may come as a surprise to a large segment of the aviation industry which knows the company primarily for its sub-orbit work (such as its data computer) and as a manufacturer of servo system devices.

Typical to the firm's progress in component technology came about a year ago when Servomechanisms was out of two lines selected by Wright Air Development Center to develop equipment capable of operating at 500C temperatures, despite heavy oxidation loss established capacity limitations.

Servomechanisms first tested the components filed in a very limited way about seven years ago out of necessity, not with idea of diversification. In dropping single component for its sub-orbit use, company found that necessary use limited by maximum oxidation obtainable with then-existing non-oxidal polycrystalline.

Company facilities started work, with one limit, on development of continuous metal-film polycrystalline which offered much film oxidation. Wright Air Development Center contract followed in 1952 to support part of the effort.

One of the problems was development of techniques for depositing thin, uniform films of metal films to provide required geometry. Servomechanisms turned to the vacuum-evaporation technique, as did Fairchild Camera & Instrument Co. and Technology Instrument Corp., both of which now produce precision film polycrystalline by this process.

But Servomechanisms were encountered a number of difficulties and surface-related problems for which it had no answer. For example, it found that the crystal structure of the films controlled its chemical properties and this in turn depended upon many factors in the evaporation process.

To obtain answers, company formed small research laboratory, staffed it with physical, chemical and metallurgists. About one year that it branched the Vacuum Film Products Division here of El Segundo, Calif. to develop and produce vacuum structure, continuous uniform improved non-oxidation techniques.

On the strength of company know-how at the vacuum-evaporation process and new materials, Servomechanisms received about two years ago a WADC contract to develop techniques for producing extremely thin magnetic films with space hysteresis loops for use as magnetic memory elements. A year later came the contract for 500C capacitors. Office of Naval Research sponsored development of technique for using vacuum evaporation to produce high temperature zones and materials in considering additional sponsorship because of the promising results achieved to date.

By Philip J. Klaus

El Segundo, Calif.—Wide variety of different electronic components capable of operating at temperatures of 500C or higher may be done at hand as result of fundamentally new techniques and materials developed here by Servomechanisms, Inc.

The development, which also may permit extensive production of complete circuits and sub-assemblies, could have a significant impact upon both atomic component and component manufacturing.

Servomechanisms has extended the vacuum evaporation process, currently used to make metal film polycrystalline, to deposit thin films of oxidizing and non-oxidizing material as well as conductive films.

This opens door to using new high temperature materials whose mechanical properties previously prevented their use in non-oxidal component manufacturing processes.

Experimental Fabrication

Company has fabricated experimentally, of six pilot run items, a wide variety of devices using the vacuum evaporation process. These include polycrystalline, evaporated, resistors, inductors, diode rectifiers, pulse transformers, strain gauges, thermocouples and magnetic memory elements with response ranges of millimicroseconds. (Most of these were not suitable for 500C operation, but were fabricated to

AVIONICS



MATERIAL is heated in vacuum chamber until its surface begins to evaporate. When evaporated material strikes cooler, non-point area, it deposits as thin film.

prove the feasibility of using the vacuum evaporation process.)

One of company's long range research goals is to develop materials and techniques for producing transistors by the same process, according to Ralph Reference, vice president of research. Reference is encouraged by success in producing deposited diodes. Company will soon attempt to produce complete computer circuit matrices by vacuum evaporation process.

Reverse the depositing of a thin film of conductive semiconductor or dielectric material upon hole plate in a high vacuum (about 0.2 micron), a high degree of attention is required for the process. While this means a higher initial investment than required for conventional component manufacturing, structures should lower cost and vacuum component reliability. Reference is a high vacuum should the Leap not impurities which cause unpredictable component behavior.

One measure of the promising potentials of the Servomechanisms program is the fact that portions of the effort are being supported by USAF's Wright Air Development Center, Army Signal Corps, and the Office of Naval Research.

The vacuum evaporation process is simple in concept but requires considerable skill and know-how for successful application to precision computer uses. When one element is heated to a sufficiently high temperature, an evaporation layer will evaporate—much as water



MANY different types of components that can be made by vacuum evaporation process are shown in samples above and below. Above, left, are deposited tungsten thin films. Above, right, are deposited magnetic memory elements for computers.

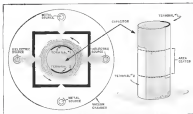


PRECISION polycrystalline element (left) has deposited tungsten, made by, and metal resistance film. Experimental transformer (right) consists of two 15-turn windings, magnetic film and dielectric, all deposited by vacuum evaporation process.



PREC Out operation, its 200 mesh size, have diaphragm film and gold plate deposited. Test sample of evaporated resistor for 500C operation are shown at right. **SEMI-INSULATED** polycrystalline shows deposited metal film element (center).





MANUFACTURE of large size deposited capacitor uses sleeve core which is exposed to two sources of metal vapor and two sources of defective vapor through four slits in neck (left). As one source, alternate layers of metal and defective are deposited.

ture to slimes at 100C temperature but not level atmosphere pressure.

If evaporative slits place in a high vacuum, the vapor escapes from the surface of high (electro and mesh) across the vacuum chamber until it is again exposed. By placing a variable shaped mask between the masked source and the exposed surface, an desired shape of deposit can be obtained and its dimensions can be controlled to a ratio 0.001 in., according to Radiozonic. By using conductor material deposited currents can be produced with considerable but not dimensional control thus possible in conventional printed circuits, Radiozonic says.

When process is variably controlled, it is possible to produce films of precise area, instead in thickness ranging from single atomic layers up to several thousand Angstroms," according to David W. Moore, manager of company's Vacuum Film Products division (Circuits Engineering 594 x 25, 1A).

Then the technique opens the way to using a stack of size high temperature materials which otherwise could not be fabricated in the required form and/or thickness needed for making components, Moore says.

Fabrication Technique

Here is how the technique can be applied to make a high temperature equivalent of a conventional paper capacitor. A metal sleeve (cylinder) whose dimensions are partially determined by the required capacitance, serves as the core. It is placed in the center of the vacuum chamber on a metal driver pedestal.

Located around the perimeter of the vacuum chamber at 90-degree intervals

are four sources, two of defective metal, two of metal conductive film, which are spaced (see sketch above) radially in a stack with two slits in placed around the core so that the two slits face the two metal sources.

The metal sources are brought up to evaporation temperature by electron bombardment. The stream of metal vapor created pass through the two slits, depositing terminal stripes along opposite edges of the core, to provide electrical connections to the capacitor. The stack is now regulated with an etcher that has four slits positioned so that each slit faces one of the four evaporator/deposition sources. When the four sources are brought up to a temperature, streams of vapor pass through the four slits and deposit at separate quadrants of the core with metal and defective films.

When the pedestal motor is started, and slimes core begins to rotate, alternate layers of defective and metal film are successively deposited to build up the familiar capacitor (left-hand) construction. Each of the two films formed

Fairchild Using Process

Vacuum evaporation process currently is being used by Fairchild Camera & Instrument Corp. to produce variable dielectric constant capable of operating at full rating at temperatures of 250C. Company publications are special publications fabricated by the process have specified "near full ratings" at 400C as high as several hundred hours. However, unlike Semiconductors, Fairchild is not currently applying the vacuum evaporation process to fabricate other types of components, company spokesman says.

is centered to one of the terminal strips radially deposited.

Capacitors of the device is vacuum constructed during the fabrication process, creating operation to be halted automatically when required value of capacitance is obtained.

New Automatic Facility

Under Signal Corps contract, Servo Mechanisms is constructing an automatic facility for making precision metal film potentiometer by the vacuum evaporation process. Facility is designed to turn out 50 potentiometers per hour. Current coils for potentiometer accuracy of 0.5%, but Moore hopes to achieve 0.1 to 0.2%.

An eight-station rotating turret built into the vacuum chamber will perform all of the critical operations under a single "vacuum seal." Coaxial slits usually loaded into a magazine, will automatically feed into the first station of the vacuum chamber where coil terminals will be deposited. The metal film will be deposited in ascending arcs after which its resistance will be trimmed electronically as required to match demands of a master reference.

Potentiometers actually produced in the new facility will be rated for ten-year duration at 500C operating temperature. With coating materials, the best may be rated to 300C, but the basic investigations now under way in company's research laboratory under Servo Mechanisms, Gold, are aimed at turning up new materials suitable for 500C (44).

Significant progress has been made in this direction, Radiozonic says.

New Materials Seen

The ability to use almost any material in the vacuum evaporation process, coupled with fundamental knowledge of electronic physics, opens new field of innovative special semiconductor research, has appeared not only areas for materials development. While present research equipment makes room limited in many materials generated by radiozonic, it is becoming increasingly possible to create new materials with properties that meet specific requirements.

For example, a non-volatile material such as silicon, because a very conductive when a tiny amount of impurity is introduced into its crystal structure. Wide range of resistivities can be obtained by choice of impurities and amount used.

The 500C equipment had many more interesting challenges in the materials researcher because the composition should, if possible, be able to operate also at room temperature or below without significant change in properties. Yet many materials need to be examined, which behave as insulators at room temperature, become semiconductors at



for interchangeable new Heineemann Series

400~ or DC service AM17 Circuit Breaker

Flying with such top-performance aircraft as the Lockheed F-104, Heineemann's new AM17 circuit breaker has demonstrated perfect reliability on both sides of the score barrier.

Hydro-magnetic operation makes the AM17 a stable performer through widely varying ambient temperature conditions. No clearing, no compensation for tem-



perature or vibration necessary.

Designed for interchangeable use on 400-cycle or DC service, and produced to military specs, the AM17 may well be the one circuit breaker for all your electrical and electronic protection requirements.

Complete specifications, including time-delay characteristics, are given in Bulletin T-3302. Send for a copy.

Single-pole AMU's may be readily ganged in the field for two and three-pole Compuserve™ applications.

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Circuit breakers



ulated temperatures (because decrease in their atomic volume leads more up into the conduction band).

The trick is to find or develop materials which have had the temperature-compressing mechanism. For example, by introducing suitable impurities into certain semiconductor materials, it is possible to obtain a material (a high temperature resistor with relatively small temperature coefficient) that has low temperature up to 500C or beyond, Redenski says. He declines to cite specific materials which lack promising, but cooperative means.

With materials now in hand, it is possible to make vacuum-deposition resistors capable of operating at 600C. This upper limit may go to 1,000C in the future, Redenski says. These high-temperature resistors should be no larger than their conventional open-air kind and can be made in corresponding resistance ranges.

500C Capacitors Made

Major problems in making capacitors for 500C operation is to find materials which retain high dielectric strength and high stability at elevated temperatures. Semiconductors but experimentally fabricated capacitors which operate at 500C and exhibit a most size-temperature product of about 3-5 megohm-centimeter using aluminum oxide dielectric.

Using boron nitride for a dielectric, Hoffman has experimentally made a capacitor which operates at 500C and have an RC product of about 30

microseconds. However, He denotes admits that it is not easy to achieve uniform film deposits with boron nitride.

These 500C capacitors are comparable in size to conventional units in values up to about 0.01 mfd, somewhat larger in higher values. However, improved techniques was made it possible to reduce thickness of deposited metal-insulator films and thus reduce size.

Promising Materials

Semiconductors research laboratory is actively investigating a class of compounds which have unusual and exciting characteristics for possible high temperature compounds. These are ternary compounds, sometimes referred to as Perovskites, consisting of two metal oxides in combination. Barium titanate and lead zirconate are typical examples. But the group also includes families of strontium, barium, cerium and aluminum.

One of the Perovskite characteristics of major interest is an extremely high dielectric constant which ranges from 300 to 50,000 times the dielectric constant of boron nitride, Redenski says.

Many of these compounds exhibit piezoelectric and ferroelectric properties. The latter property suggests possibility of making semiconductor film electric flip flop circuits by the vacuum evaporation process.

Another type of material, called non-stoichiometric compounds, is being investigated for use in making deposited



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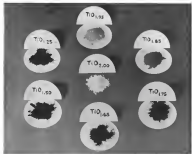
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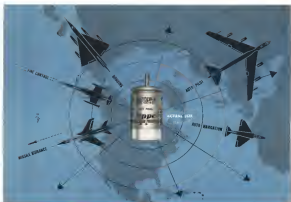
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UNUSUAL FORMS of titanium dioxide, which have been "bobbed" at some of their oxygen atoms to form these nonstoichiometric. It is now producing new material being produced.



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 use Clifton Precision Size 8 Synchros
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| SYNCHRO | SYNCHRO AS PRIMARY | | | | | SLIDER AS PRIMARY | | | | | S.E. READING | | IMPEDANCE | | WGT. GR. | WGT. OZ. |
|-------------------|--------------------|---------|---------|---------|---------|-------------------|---------|---------|---------|---------|--------------|---------|-----------|---------|----------|----------|
| | 100 | 200 | 300 | 400 | 500 | 100 | 200 | 300 | 400 | 500 | 100 | 200 | 100 | 200 | | |
| Model Number | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | 32 | 1.15 |
| Model Name | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Code | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Weight | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Impedance | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Resistance | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Inductance | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Capacitance | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Voltage | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Current | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Power | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Frequency | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Temperature | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Humidity | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |
| Model Shock | 502-1-1 | 502-2-1 | 502-3-1 | 502-4-1 | 502-5-1 | 502-100 | 502-200 | 502-300 | 502-400 | 502-500 | 502-100 | 502-200 | 502-100 | 502-200 | | |

LOOK TO CMC FOR SYNCHRO PROGRESS
CLIFTON PRECISION PRODUCTS CO. INC. Allentown, Pa.

techniques. By enclosed techniques, company scientists take a compound like titanium dioxide (TiO₂), deliberately "soak" it at various of its oxygen content to change the crystal structure. This leaves it with a surplus of electrons on the conduction band, making it an N-type semiconductor. Redwood refers to the resulting material as a "solid-metal" to denote its strong oxygen, or in TiO₂, although he admits that most chemists will argue that the number of oxygen atoms must be shown as an integer and that doped semiconductors are not based on classical textbooks.

Company has created a variety of sub-oxides of titanium, ranging from TiO_{1.5} to TiO₂, as shown in photo, p. 74.

350C Diode Rectifiers

But the important thing is that the material can be deposited by vacuum-deposition techniques and that it provides positive action at 350C. Titanium sub-oxide is not the best possible material, but Redwood says Semiconductors has better ones which he declines to identify. Semiconductors has not yet investigated contact reaction properties of these materials by diffusion, whether resistor values can be achieved, but ties it on the open.

Research into high temperature materials has used some knobby fabrication and manufacturing products. For example, to form certain materials into

solid pieces for test or vacuum deposition process, they must necessarily be subjected to extremely high temperature and pressure.

New Hot Press
 Lack of suitable furnace on the market forced Semiconductors Research Laboratory to develop its own "hot press" which can raise material temperature to 3,000C and simultaneously subject it to compressive force of up to 5,000 psi. Operation can be carried either in a vacuum or with furnace filled with inert gas at desired pressure.

Laboratory also was forced to design and build its own measurement facilities for checking electrical properties of materials while sample is at elevated temperatures.

The promising new materials are treated to by mistake, the Vacuum Film Products division takes steps over to evaluate their suitability for the vacuum-capsulation process.

WADC contract for development of 300C capacitor coils for device that is also nuclear radiation resistant. Although no radiation tests have yet been run on experimental units, Redwood is hopeful that inherently distributed crystal structure suggested to obtain material with high temperature characteristics will tend to make it less vulner-



EXPERIMENTAL hot press, developed by Semiconductors for research in new materials, can subject those to 3,000C temperature and 4,000 psi compressive force in a vacuum or inert gas.

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Beware of the Shark!

The nation's first intercontinental missile... the Air Force's Northrop Shark SM-62. Equipped with a nuclear warhead, the Shark is a modified suborbital missile which travels in the earth's atmosphere. Its conical design presents a smaller target for radar, interceptors, or anti-aircraft missiles.

Extremely mobile, the Shark can be air lifted to any site within a few hours.

The pilotless bomber is powered by a Pratt-Whitney Aircraft J-57 turbojet engine equipped with a Holley compressor bleed program. It flies in a low-altitude corridor above the weather over the longest range yet possible by a missile in the free world today.

Like all Holley engine controls, the compressor bleed governor is dependable, easy to service, compact and lightweight—four vital qualities for aviation equipment.

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able to maintain design performance over scheduled tests at the Brooks base.

Serviceability has no target time table for setting up to supply high temperature components on a production basis—except for the Army Signal Corps polystyrene facility. Rademick does not minimize the amount of materials research that lies ahead, but he says that considerable progress has already been made. It appears reasonable to predict that Serviceability may become a source for extremely high temperature components in a variety of fields within the next few years.

Equally important, Serviceability's progress to date can be expected to establish component manufacturers to anticipate the planning synchronization process.

Expansions, Changes In Avionics Industry

Norwalk, Conn., North Hollywood, Calif., is a area of new firms formed by merger of El Rio Motor Co., maker of marine outboard Volvo Engineering Co., maker of marine capacitors, and National Electronics Corp. manufacturer of SBCs, transformers and audio hearing devices John N. Valavan is president of new firm, plants are located at 11747 and 11845 Norw St.

Other recently announced expansions and changes in the avionics industry:

- American Machine & Metals, Inc. has purchased name and certain assets of Rubin Instruments, Inc. and listed the latter's plant at Westbury, N. Y. Now, supposedly to be known as Rubin Instruments division, manufacturer electro-mechanical instruments for aircraft and missiles.
- American Bosch Airco Corp. has launched \$2 million expansion and modernization of the Garden City, N. Y. plant of its Avco division. Plant call for at \$400 sq ft "sketch area" for making integral guidance components and 72,000 sq ft of new assembly facilities.
- C. P. Clark & Co., Chicago, maker of valves and components, will build new \$4 million, 40,000 sq ft plant at Fairport, N. C., where company has been operating for two years to meet quarter competition is scheduled for June 1955.
- Westinghouse Electric Corp. has completed new \$30,000 sq ft wing of its Air Force division plant in Baltimore.
- Hoidt, Inc. is maker of new electronic control research and development facilities located in 10 former members of the Massachusetts Institute of Technology's Dynamic Analysis and Control Laboratory. New company, which has opened temporary head-



Talos Guidance

Present AN/SWG-49 radar will provide slant-range guidance for Talos interceptors for launching tube range of about 500 miles. Servoactive guidance system in the missile uses reflected energy to locate on target Sperry Gyroscopic Co., which developed the SWG-49, tests near 200,000 miles in production contracts plus more than \$14 million for similar AN/SWG-49 missile guidance radar for the Force and anti-air missile.

quarters at 99 First St., Cambridge, Mass., is headed by Ernest St. George.

It holds plans to develop and market latest new control components and systems as well as provide consulting service to industry.

• Transair Engineering Corp., Culver City, Calif., has licensed Canadian Applied Research Ltd., Toronto, to produce certain of Transair's electronic instrumentation power supplies.

RESEARCH CENTER

- Communications Ship-Shop—Variety of communication system problems can be specially solved and effect of change in parameters evaluated on new Graphic communication system calculator developed by Galton Industries, Metuchen, N. J. New slide rule, priced at \$2.00, takes into account such variables as transmitter power, frequency, air layer bandwidth, signal noise figure, input signal level, path loss, antenna gain and total path distance and directional loss to distance.
- Short Circuit Protection—Transformer used a.c. to d.c. converter, which suffer no damage from short circuit across line and whose short circuit current drops to about 10% of rated current within about 50 microseconds, have been developed by Transair Engineering Corp., Culver City, Calif. (In-

current step, after short circuit reaches about 150% of full load current but less only about 15 microseconds, constant time.

• RCA and IBM Exchange Polytechnic exclusive agreement to exchange terms on digital computer and data processing machine projects has been signed by Radio Corporation of America and International Business Machines Corp.

• Case of Failure—Mapping out of case, 5% of the components in system equipment produced 55% of the high failure rates, according to performance analysis made by Hughes Aircraft Co. on 5 million sample parts in 18,000 units.

• Calling All Airbuses—The 1955 Electronic Components Conference, to be held April 22-24 at Ambassador Hotel, Los Angeles, is seeking technical papers on: components, interlocking, testability and their interrelations, and component reliability. Potential air there should write to E. E. Boreck, General, Personnel, C-1, before Nov. 15.

• Kern Competition—Radio Corporation of America, originally set up as second source producer of Hughes interceptors for control systems, now is hotly competing with Hughes to get RG-4-developed system in medium range interceptors being developed by North American Aviation. One of RCA's big selling points is the long range of its new airborne radar. At one point, an oral analysis says, CWAF is probably won considering availability of strong RCA radar in Hughes for control system being used F-106.

• Signal and Sodek—Contract awards recently announced include:

- Westinghouse Electric has received \$10 million Navy Bureau of Aeronautics contract for production of AN-28 radar-directed bomber and target systems for use on A-1J and a \$3 million contract from Bureau of Ships for shipboard anti-aircraft radar.
- Avco's Avco Division has received Air Force letter contract for instrument production of B-52 radar-directed target targets. Annual figure is \$8 million, but is expected to reach \$10 million by completion of program.
- Traffic Control Studies—Arizona Research Foundation is making digital computer to simulate flow of air traffic in peak, sponsored by Army Signal Engineering Laboratories and Air Navigation Development Board. Objective is to determine effect of changes in route structure and rate of the control system on traffic impact.

FURNACE FOR MISSILES!



Brazed all-metal honeycomb sandwich saves vital pounds in high-speed missiles

HEAT AND STRESS RESISTENT materials are of vital importance in the exciting area of missile technology. Stainless steels and high alloys are the best bet to date for hot-speed applications—but the specific gravities of these materials present a problem. Solar advanced technology has helped solve this problem with all metal honeycomb sandwiches.

Solar's—a steel and high alloy sandwich structure developed by Solar—is a brazed material of flat thin ribbons bonded between metal skins. It is lightweight, has remarkable heat resistance at speeds

approaching Mach 3 and can withstand pressures that would crush unstructured metal.

Large new electric furnaces—the only ones of their type—were designed by Solar to braze the sandwich structures. In addition to stainless steel, various high alloys are used for the honeycomb cores, and research in the use of other metals is in progress. For more than a decade Solar has placed special emphasis on guided missile technology—developing new metalworking techniques for the missile age. Solar's versatile missile team is

available now! For more information write to Missile Engineering, Dept. D-50, Solar Aircraft Company, San Diego 12, California. Designers, developers and manufacturers of gas turbine engines, expansion joints and aircraft engines, airframes and missile components.



DOMESTIC WANTED Delivered anywhere, challenging projects, good living with Solar! Write for new brochure.



SMALL ONE CHANNEL elevated temperature structure test facility used for equipment development by Westinghouse engineers. Left to right are the Berkeley EASE computer console, curve-following console, radiation power controller and heat lamps. Draw-type error follower now conducting work on graph to keep pencil for pressed against paper on drum.

Infrared Simulates Aerodynamic Heating

By Robert H. Cassano

Infrared heat lamps that simulate thermal fluxlets are expected to soon take their place alongside conventional wind tunnels and stress stands as important development tools for aerospace aircraft and missiles.

Largest order effort in this new type of facility has been from the aviation section of Westinghouse's Transportation Sales Dept., East Pittsburgh Works, Pittsburgh, Pa., but other users (such as Spac, a small electronic firm in Wynnton, Pa., General Electric Co., the exclusive supplier of the heating lamps, and Research Inc., Minneapolis, Minn., are selling components and are considering offering integrated systems later.

Westinghouse estimates the dollar volume for this particular type of testing equipment to be \$14.5 million over the next year.

Lamps Form Oven

The ETSTF (elevated temperature structure test facilities) or components thereof being produced by these companies consist of bottom of GE T-3 quartz infrared heat lamps arranged around the tested aircraft or missile fusage.

The heat lamps are run at many times above the rated 1,000 watts and in effect form a virtual heat oven which will produce the temperature range of about 150F per second to 2,500F temperature levels.

The lamps are divided into groups which are operated over the test part

proportionally to the expected aerodynamic heating which has been either calculated or deduced from various flight tests.

Each of the lamp groups in turn is looked into its own control channel and programmed to follow a curve which represents the heating variation of that section over the duration of a particular flight mission.

The purpose is to heat out under controlled conditions just how the aerodynamic heat from the area flows in through fusage and fuel tanks, etc., to the interior of the vehicle. It is important to know this because the most heat flow in a high-speed missile may cause such unexpected catastrophe as buckling of the load-carrying structure due to unbalanced thermal expansion,

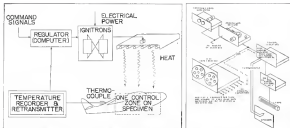
cracks at unstable flight due to thermal warpage of the flight surfaces or failure of internal electronic and propellant components due to overly rapid heat flow.

Manufacturers Interested

At present ETSTF installations are limited, but interest from nearly all the major aerospace companies indicate that installations will be built up rapidly. Among those who either have contracts involving equipment or who are interested in purchasing this type of equipment are: General Corp.'s Missile Division, Boeing Aircraft Co., Lockheed Aircraft Corp., North American Aviation, Inc., Republic Aviation Corp., Convair, Bell Aircraft Corp., the Martin Co.'s Denver division, the Aero's



CLOSEUP of quartz-crystal heat lamps directed down on portion of aircraft wing in Spac experimental run. Small spots on skin are for thermocouple leads, in actual tests high-heat pressure strain gauges would be used too. For pictures of actual thermal test being run by North American Aviation see AW Jan. 28, page 67.



SCHEMATIC of Westinghouse EITSEF (left) and diagram of heat control system. While Westinghouse uses a drum type programmer developed by Analogue Research Spar (see other 2 graphic illustrations) controls for tube or specific flow type Spar believe that a pulse-width modulated system using type magnet will provide the most compact, flexible method of programming the temperature and acceleration loads for different trajectories.

Robotic Arsenal at Hawthorne, Ala.

Two of the most elaborate facilities to construct are at the Navy's Aeronautical Structures Laboratory (Philadelphia), and at USAF's Structures Laboratory, Wright Aeronautical Development Center, Dayton, Ohio.

The original portion of the USN experiment consists of 4,000 lbs divided into 40 channels of 100 lbs each.

Navy Experiment

Each channel is controlled by a variable core reactor (isotope assemblage) programmed by a Spar circuit to take some feedback. Temperature feedback from a thermocouple on the

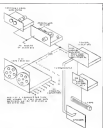
test specimen is used to keep the test model's skin temperature close to the program curve.

The Navy is now in the process of adding another 4,000 lbs. The additional power will be composed of 12 channels of 500 lbs each in which faster response rate ignitron electronic gear is installed. In Westinghouse will be substituted for the variable core reactors. With the 8,000 lbs, the laboratory expects to be able to cover 1,200 sq ft model surface. The laboratory's present test work is directed toward looking out how structure frequency changes with heating rates for the prediction of high speed fatigue plus stresses.



Model Refueling Dock

Model of proposed E-3 refueling station shows combined area carrying fuel tank to DC-7C for maintenance refueling. Cost is estimated at \$60,000 if tested out of conventional outline. E-3 and Boeing 707 could be fully fueled in about 17 minutes.



The USAF WADC setup was originally developed from automatic core reactor technology by programs made by Research, Inc. However, the test rigs inherent in suitable core reactors have caused stability problems during rapid thermal accelerations and USAF has especially become interested in Westinghouse specific tube control.

The significant difference between the WADC and USN installations, though, is that while the USAF facility attempts to heat its test areas the amount of heat transferred, the USN facility settles for skin temperatures as the test reference. While identical that the Wright-Patterson approach is three times the speed of the Navy laboratory because that for the test being the more accurate quantity of skin temperature ought to be used.

Drawbacks Experienced

Early test air troubles. The trouble with using skin temperature is that it is difficult to calculate. Unless you have made actual light flow measurements on a sample on surface of same type, you are never sure of the accuracy of the starting point of your calculation.

The difficulty of using heat transferred data with the feedback and power flows is a lesser statement which will doubtless increase the heat transferred to the test area, you must use such indirect means as either measuring the power you put into the heaters or introduce a compensating channel to take the dynamic of the skin temperature of the skin as reference. "This really then." In this case, completed

approach you also have to manufacture the desired rate of thermal energy input. This is done by a compensating element which solves the equation of heat transfer coefficient times the temperature difference between the boundary layer and the skin.

Inadequate Facilities

A source of error which is to varying degrees common to both systems is the greatest uncertainty about the exact nature of the heat transfer in the boundary layer.

Compared to EITSEF models within the field feel that most other existing facilities are both crude and limited in capacity. In general, surveys show

that the usual developer must faster responses and higher maximum heat loads and that the entrance developer usually must larger capacity. Then, while aerospace manufacturers agree to be satisfied with equipment which would produce 100,000F skin temperatures (Mach 5.0) at up to 15 minute duration, missile manufacturers want heating rates and temperatures as high as 5,000F in 10 seconds, according to Spar.

Heat Flow Rates

According to Westinghouse, heat flow rates would be up to 30 kw per sq ft for automobiles and up to 100 kw per sq ft for missiles. For the



Vulcan Bomb-Aiming Position

Avio Value B, L, line starting operation service in one group of Bomber Command, the most bomb-aiming position with variable slotted con-blew cone compartment. Does behind a cone extreme, the exit the downward position and.

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NAA IS AT WORK IN THE FIELDS OF THE FUTURE



THERE'S A NEW KIND OF MANNED AIRCRAFT AHEAD

No aircraft will ever duplicate man's unique ability to meet an emergency or to make the most of an opportunity. That is why the air crew team is still the decisive factor in our nation's defense—and may always be so.

And our strategic needs are being brought to reality by our all-out effort by the military and industry. They will be potent additions to the nation's arsenal.

But for maximum security in the peace ahead America also needs manned aircraft whose performance will be so advanced as that now being developed in missiles. The combination of man's judgment and higher-performance planes may always be our most versatile, flexible, and accurate weapons.

These new aircraft will fly so fast, so high, so far that they will be invulnerable to manned aircraft. They'll be able to bomb any target on earth with pinpoint precision—or to launch the warhead stage of a missile from the edge of space. And their advanced electronic electronic control systems will free the pilot for what only he

can do—make command decisions.

Each aircraft is now in development at North American. Extensive studies are being made into every aspect of the strategic bomber of the future. To this task North American brings the greatest store of experience anywhere in the Free World. North American has built more supersonic aircraft than all other companies combined. These studies, in collaboration with the U.S. Air Force, have already resulted in a unique design concept for Weapon System 130, an incredibly fast upper-altitude manned chemical bomber with global range.

Another outgrowth of North American's supersonic experience is the X-15, a rocket-powered research plane that will fly man faster and higher than he has ever flown before.

Again and again, North American has demonstrated its ability to translate ideal performance into wing-strength, performance—accurately, rapidly, and at lowest possible cost.



Bomber-Pusher

This All American Engineering concept combines a low-pitch, curved configuration, tilted air/line with fixed leading gear to push heavy bombers during take-off to shorten take-off run and fully during actual dash-out. Cockpit is a part of its leading edge

and fuselage. After bomber has reached a predetermined altitude, pusher plane drops up, detaches its probe from the bomber and returns to base by the next day. Illustrations show how concept would work with a plane pushing a B-47 at over 5000-foot gear

immediate take-off. Working loads set below temperature requirements will go above 2,000F (roughly Mach 15).

Working loads greater \$25-50 per lb. while Spurt fills in terms of \$10,000 \$4,000 per each 100 kw channel. A facility to test a complete B-55 might cost \$5 million.

Problems Exist

Before enlarged facilities can be built and part to prototype are a number of problems must be solved. The first is the previously mentioned matter of resolving the phenomenon underlying the transfer of heat to the boundary layer so that some precise heating program may be fed into the test.

Then there are several more practical problems which exist down on the test-bench level.

One problem is that of perfecting a

low-inertial point or coating for the test model so that it will efficiently absorb nearly all the infrared energy directed at it.

Severely treated and graduate in liquids have been studied but tend to lose their thickness after repeated heatings.

Another is that of how to realistically apply mechanical loads without damaging the IR interface.

At the present time the Navy is using high-overloads which apply the various loads by means of rods and are also time-programmed through the entire test.

Applying Loads

For the future the test engineer is considering using small rockets to apply sudden loads (for example, due to a sudden turn command) and loads applied by electromagnetic fields.

But one of the most forbidding problems, at least for the smaller company, is the problem of a power source for the large, relatively short, bursts of electrical energy which are typical of missile testing.

Some of the present power controls further aggravate the situation by pulling a tapered load power increase.

Power Expensive

In a recent study, the Navy Structures Laboratory in Philadelphia discovered that it would cost as much as 5 million dollars to have the Philadelphia research company put in the additional time for another 12,000 lbs. of power to bring their total to 10,000 lbs.

Further, the nature of their load would cause a maximum of \$1.2 million annually for power used, even though

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they might not see all load over five hours per year.

Obviously this could be a remaining factor, especially for the Philadelphia laboratory, which has astronaut plans

of going up to the 30,000 feet needed to test a whole aircraft in ten years. Vaneck already poses criteria for the B187's air now under consideration. One of the cost problems is to meet

as 51 million worth of storage batteries which are being rebuffed at least. The dc output of the batteries would be controlled by a special electronic system now under development.



TWO NEW pressure helmets developed by Bellah compare the Taylor helmet (left) and G. Q. Partridge Company's suit (right).

Helmet Visor Worn Up in Normal Flight

Highlight of the Taylor pressure helmet is that face visor is normally open, eliminating possibility of fogging and giving pilot a sense of freedom. If cabin pressure falls, visor is lowered and locked into position by the same pressure-acting system that operates pilot's pressure suit. Thus pilot can be free of the visor as long as cabin pressure remains normal.

Through-hole sequence (top to bottom) shows face visor as lowered to protect pilot in case of cabin pressure loss. Other features of helmet include hand at center buttons for in-flight feeding, quick release and crash protection. Helmet was developed in cooperation with Royal Air Force and Institute of Aviation Medicine, Royal Aircraft Establishment, Farnborough.

G. Q. Partridge Company's pressure helmet, with main visor, is shown on descent gear but is completely leak tight during gear (upper right). G. Q.'s pressure helmet shell (lower right) was also developed in collaboration with the Institute of Aviation Medicine, Singapore referring to Cosbren's altitude record is indicating more crew wear different type of helmet on that flight.



First in Constant Speed Drives



**Boeing's B-52 for SAC
to be equipped with
SUNDSTRAND DRIVES**

The Strategic Air Command's Boeing B-52's are now scheduled to be equipped with Sundstrand Constant Speed Drives. Four Sundstrand Drives will provide—under all conditions—the precise frequency control and accurate load division that is mandatory in an accurate, parallel, 400-cycle electrical system. In addition to their inherent reliability, Sundstrand Drives will contribute to improved aircraft performance because of lighter weight and higher efficiency. Application of Sundstrand Drives on the Stratofortress gives further evidence of the record of reliability and performance that keeps Sundstrand first in constant speed drives.

ONE OF MANY MODELS

The "Torque-Type" drive, at right, gives the close frequency control to the automatically paralleled alternators in the B-52. Package drives can be adapted to use either independent oil system or engine take-off system. Other Sundstrand Drives can be custom engineered to fit your space, weight, mounting, and IFA requirements.



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The Aero 13 fighter armament control system as installed in a U. S. Navy F4D fleet aircraft.

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The KLIXON M-1 thermostat, a miniature, hermetically sealed control which limits temperature in the Aero 13 compartment.

A miniature KLEXION M-1 Thermostat plays a vital role in the effective operation of the Aero 13 fighter armament control system developed by Westinghouse for U. S. Navy use. This KLEXION Thermostat, which conforms with military specifications MIL-E-3272A and MIL-T-5574A, limits temperature in the pressurized compartment of fighter planes in which the Aero 13 system is installed.

Westinghouse has elaborate programs of quality control, test, and inspection at the Air Arm Division to make certain that the highest standards possible are maintained.

Their tests show that the KLEXION M-1 Thermostat meets the requirements in its particular application in the Aero 13 fighter armament control system which is manufactured by Westinghouse for the U. S. Navy.

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Low Cost Reflector Aids Landing, Taxiing

Highly reflective, inexpensive plastic reflector for airports with no lighted landing strips has been developed by Dumas Specialties, Inc., Hingham, Mich. There are over 7,500 unlighted airports in the U. S., according to Civil Aeronautics Administration figures. The three-inch units can also serve as runway guidance indicators for lighted landing airports.

Dumas Specialties uses 700 cc Bakelite base resin molded for low-temperature at Chicago's Midway Airport, a permanent installation will be made at Birmingham's Beech Field.

Reflector is made of Plexiglas. Its 12 sides each have three facets placed at different angles to pick up maximum illumination from plane's landing lights. Each unit contains 2,500 separate points placed 500 deg. around reflector. Reflective facet placement allows reflector to be seen from any point of the compass and from almost any height or approach angle. This allows pilot to see the reflector in low-visibility conditions from the air, three miles and see units on ground in landing.

Manufacturer says unit effective spacing is 70 ft. apart at approach end of runway, gradually spacing to 100 ft. Units, which are already weather proof, are available for lightweight metal roof rack to ground.

Reflector string or tapes as used on towers, could be useful in marking runways, according to the maker. They can also be mounted on road curbs for night visibility.

Units can be supplied in clear (which is the most reflective), amber, red or green. Larger version model will be available in about two months.

Current three-inch size sells for \$2.98. In quantities of 200 or more, cost is slightly less than \$1 each.



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This "heads up" life jacket is a result of Air Cruisers' continuous research in survival problems. It was made available to the aviation industry and the military only when the answer

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SEEING EYE

Infrared systems research at Perkin-Elmer helps provide "super-sight" for military aircraft

In modern military aircraft the art of seeing requires a specialized sensor. The name is infrared.

Infrared systems were born of the limitations which ultraviolet, darkness and signal jamming placed on conventional reconnaissance devices. Today, infrared systems for reconnaissance and missile-defense detection are becoming standard equipment on our latest aircraft. Perkin-Elmer has pioneered in the infrared and optical research which has made these systems possible.

Perkin-Elmer is maintaining its long leadership in the design and manufacture of the capacity of infrared sensitive instruments in use today.

In design and production know-how have demonstrated respect throughout the world for the military. Perkin-Elmer is actively engaged in the development of new infrared systems. Some of the results that have been achieved may be seen in a special film available for showing to persons who can establish proper clearance and need to know. For information, please write to at 770 Main Avenue, Norwalk, Conn.

ENGINEERING AND OPTICAL DIVISION

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Lightweight infrared systems, ultraviolet and laboratory models, designed by Perkin Elmer, and infrared detector heads shown to —70°C, greatly increase detector sensitivity.

OFF THE LINE

Caldine Co. of Winchester, Mass. is building 54 engines, 46,000 sq. ft. plant under an expansion program. To



clear, which will be completed in early 1958, at an estimated cost of \$1,000,000. Caldine makes electrostatic vibration test equipment.

Seats for Lockheed's turboprop Electra will be manufactured by Harbison Tool & Engineering Co. under Lockheed specifications. Seats will include leather chair, telescopic and high dash type. Harbison is already in production on special lounge seating for the Electra.

Paper-backed volume containing about 10 papers on X-ray diffraction, spectroscopy, and ultrasonics will be available about mid-November at \$4.50 per copy. Volume contains the proceedings of the Sixth Annual Conference on Industrial Applications of X-Ray Analysis held in the Denver Research Institute, University of Denver, Denver 10, Colo.

Fourite fibrous rubber tapes available from the Fibrous Division, Union Carbide Corp. Tapes, which become sticky under pressure, represent a complete departure from usual silicone rubbers which are noted for their non-sticking properties. Feature of the tapes is their resistance to loss of modulus under heat. Type applications include cable wrapping for electronic equipment on coastal and submarine. Address: 30 E. 43rd Street, New York 17, N. Y.

First commercial work of the Cal-Vac airtight vacuum cleaner has been delivered to Boeing Airplane Co. by Coleman Engineering Co., Inc., Fresno-Tulare Co., which will handle Cal-Vac manufacturing and sales, is currently building an 11 service test units of the machine for the Air Force and Navy.

Engine test cell, capable of handling Rolls-Royce RD-1 and RD-5B turboprop engines, is being built by Continental Air Lines near Stapleton Airfield, Denver. Installation will cost about \$750,000. CAL is getting 15 Vietnam Super Viscount, starting March 1958.

Engineers and Scientists

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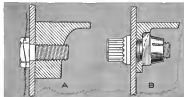
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FASTENER PROBLEM



Self-positioning blind fastener for jet engine flange assemblies

There have been two commonly used methods for fastening flange-type assemblies on jet engines—for such applications as attaching compressor to rotor sections, stator diaphragms to case sections, and securing air seals. The most common design practice has been to use a flange structure thick enough to provide tapped bolt holes with sufficient axial thread length to carry the design load. (Illustration "A") Method number two was to use a flange-type section supplemented by conforming metal "tapping" strips with threaded bolt holes. In both cases the flange assembly carried a heavy weight penalty, and extra labor and material costs were involved in the installations of the locking devices or nut assemblies.

Solution: Such applications have become even more critical with the development of engine designs which eliminate the main rotor shaft by conservatively fastening each compressor stage to its neighbor. The need for a dependable time-and-weight-saving "blind" fastener is met by ESNA's Type ZL2440 self-sealing fastener. The shaft on this Elmitic Stop® nut is permanently fixed into place on the locking flange. The part is generated from turning by its own axial log on the nut which bears against a shoulder on the flange. (Illustration "B")

Type ZL2440 is available from A388 alloy stainless steel to guarantee exceptional tensile performance at elevated temperatures. The ESNA long-beam locking device assures dependable, tested, self-locking performance at elevated temperatures. This new fastening method provides major weight savings through flange redesign; it also results in considerable time savings and lower costs.



ASK OUR COUPON for design information on the ZL2440 nut and other ESNA self-locking fasteners.



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WHAT'S NEW

Publications Received:

Thermal Strains—by R. E. Gatenhead—Pub. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. \$14.90, 458 pp.

This publication covers all phases of the design problem at elevated temperature. Special applications are given to airplanes, missiles, turbine and nuclear reactors.

Fastener Handbook—by John Seled, D. E.—Puls Research Publishing Corp., 430 Park Avenue, New York 22, N. Y. \$12.95, 657 pp.

Pertinent data, illustrations and full page descriptions apply you with detailed information on currently available fasteners.

Physical and Thermodynamic Properties of Titanium Compounds—Pub. The Office of Naval Research, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. \$2.00, 448 pp.

This book brings together in one place the existing thermodynamic and physical data on compounds of current or potential interest to the extensive metallurgy of titanium.

Aircraft Hydraulic Design—by George Kellom—Pub. Applied Publications Magazine, The Aerial Publishing Corporation, 572 Haxon Road, Cleveland 15, Ohio \$3.90.

The first book dealing with hydraulic component and system design for high speed, pulsed aircraft and missiles.

Reports Available:

The following reports were sponsored by the Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

Titanium Determination—by R. W. Menaker and J. E. Schweitzer, Wright Air Development Center, U. S. Air Force 51 80, 19 pp. (PB 121815).

Development of Low-Alloy Chromium-Nickel Stainless Steels for High Temperature Use—by Cornell Aeronautical Laboratory, Inc., in Bureau of Aeronautics, U. S. Navy \$2 26, 86 pp., (PB 121024)

Tangor Brittleness of Boeing Testbed Steel—by S. J. Romberg, National Bureau of Standards for Wright Air Development Center, U. S. Air Force 51 75, 66 pp., (PB 121899)

Development of Cast Iron-Base Alloys of Austenitic Type for High Resistance

and Scale Resistance—by F. Ehrlich, J. H. Hiller and W. E. Lyda, Babcock and Wilcox Co. Research Center for Wright Air Development Center, U. S. Air Force 52 10, 99 pp., (PB 121950).

Summary of Joint FPL-TDC Simulation Activities in Air Traffic Control—by S. M. Bechtold, B. L. Truitt and R. S. Miller, Franklin Institute Laboratories for Research and Development, Technical Development Center, Civil Aeronautics Administration 51 00, 32 pp. (PB 121979)

Comparison of Four Methods of Encoding Electrical Information with Complex Line-Information Systems—by D. B. Lerner and E. A. Allen, Ohio State University and GRI Research Foundation for Wright Air Development Center, U. S. Air Force 5 75, 27 pp., (PB 131003)

The Effect of Various Heat Treatment Cycles Upon the Mechanical Properties of Titanium Alloys with Vanium Interstitial Levels—by B. F. Hagley, G. W. Ross and D. Evers, Military-Space Titanium Corp. for Wright Air Development Center, U. S. Air Force 51 10, 220 pp. (PB 131009)

The Effect of Microstructural Varieties and Interstitial Elements on the Fatigue Behavior of Titanium and Commercial Titanium Alloys—by C. B. DeVries, C. W. Bacon and D. Evers, Military-Space Titanium Corp. for Wright Air



Strong Adhesive

New adhesive for bonding polyethylene to brass or natural rubber and many synthetic rubbers, which was withdrawn because of 1,000 psi, has been developed by Bell Telephone Laboratories. New adhesive is a synthetic known as "partly hydrogenated polybutadiene." Bonding is accomplished by applying adhesive in less than three seconds; this applies pressure of 100 psi or less at temperature of 250 to 350°.

Development Center, U. S. Air Force 52 38, 96 pp., (PB 131972).

Research on Elevated Temperature Resistant Concrete Structural Adhesives—by H. C. Lofert, R. M. Spitzer and D. G. Herzog, University of Illinois for Wright Air Development Center, U. S. Air Force 51 00, 74 pp., (PB 121042).

Atomic Energy Commission Studies on Health and Safety: ARCCU-458 Workwide Effects of Atomic Weapons, Part one Summary, Aug. 1953—5 55, 104 pp. ANL-5854 Environmental Radioactivity at Argonne National Laboratory, Re-

port for the Year 1955, Feb. 1957—5 15, 20 pp.

ANL-5684 Gloss for Protective Enclosures, May 1955—5 25, 22 pp.

NYC-4734 Radiative Protection Within a Standard Housing Structure, Nov. 1956—5 15, 10 pp.

ORNL-2334 A Study of the Distribution and Excitation of Vanadium in Max. an Isotopic Report, 4-6-54, 58 pp.

WT-1218 Evaluation of Various Types of Personnel Shields Exposed to an Atomic Explosion, Operation Yeager,



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Jet Deflector Fence Gets Test

Sasha, test deflector fence case are deflected by series of Model CV 10-12 jet blast source tested at CofA AFB near Nevada, Calif. Fence consists of 80-ft-long, one-ton sections that stand 12-ft high when erected at 60-deg angle. An F-105 jet engine 1,000-ft away at CofA. Exhaust blast is deflected 90 deg upward by 15 curved, inclined vanes. Enduring hour of single chamber pressure loading, pressure maintained less of high velocity blast. Strong designed source, which was fabricated by John Bern Div of Fluid Machinery & Chemical Co., San Jose, Calif.

Nevada Test Site, Project 54-I and 34-I, Mar 1956; 5:10, 12; 14 pp.

UR-487 Speed Difference in the Meta-basis of Polaron 210, Apr. 1957; 5:20, 17 pp.

UR-488 Some Effects of Thickness of the Layer in Protection Against Flash Burns in Cream, Mar 1956; 5:10, 11 pp.

WT-482 Utilization of Telemetry in Inspection on Evaluating Residual Radioactive Contamination Operations Tripod, Nevada Test Site, Project 50-2, Feb-Mar 1955, Nov. 1956; 5:75, 11 pp.
WT-486 Measurement of Oil-air Fuel-air by Automatic Monitoring Station, Operations Tripod, Nevada Test Site, Project 50-1, Feb-Mar 1955, June 1957; 5:10, 20 pp.

UR-489 Protection from Radiant Thermal Energy in Fabrics Used as a Shield, June 1957; 5:11, 10 pp.

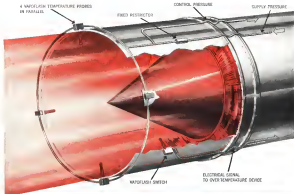
WT-4176A Beta Window Measurements by Specially Designed Film-pack Dosimeters, Operations Tripod, Nevada Test Site, Project 57-3, Feb-May 1955, Mar 1957; 5:75, 14 pp.

Telling the Market

Revision of Screw Thread Standard H28 and illustrated description of new gaging requirements, American Gage Co., Inc., 5625 West Slaus Ave., Los Angeles 45, Calif. Over four hundred electrical products and testing devices illustrated and described. Also catalog No. 12-B, Hulse Toolworks, Inc., Syracuse, N.Y. Specific rationale of electrical accuracy laws for consistent measurement of jet area for pressure, Data Sheet 500, Vacuum Equipment Division, 1 J. Seidel Corp., 5593 Taylor Rd., Philadelphia 21, Pa.

Price, stock and delivery information on company's lines of stainless steel and alloy fasteners, catalog, Anti-Corrosion Metal Products Co., Inc., Corfu, Pa. or Hudson, N.Y. RCA High Insensitivity Noise System brochure (Form 1R1182) covers specifications, gives up-plexion information, describes testing procedures, etc., Radio Corporation of America Electronic Instrumentation Section, Bldg. 155, Columbia 2, N. J.

Detailed description of lubrication circuits, automatic protection, and valves and pressure of 800 type and Le-Rex stainless steel components, Tepecolor folder, Sales Promotion Dept. Le-Rex Division, Westinghouse Air Brake Co., Milwaukee, Wis. Features and specifications of hydrolic power packs for diversification operation



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Here is New VAPOFLASH™ in Metal! Four or more VAPOFLASH electronic probes are retained in the turbine exit gas stream to provide an average measurement of the gas temperature. Constant pressure is fed through a fixed restriction to a stainless steel casing surrounding all VAPOFLASH probes. The control pressure leads to the major fuel control. When the gas stream temperature acts upon the control lead, the VAPOFLASH probe begins to bleed air to the atmosphere, reducing the control pressure proportionately. The power level of this control pressure signal is in three forms: Two size relays that can be used to indicate engine fuel flow. The VAPOFLASH technique is equally applicable to afterburner fuel control and variable exhaust ramjet control.

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probe, angle-thru control system operation at a desired temperature. When calibrated to a higher set point than the pneumatic probe, this unit will provide an electrical control signal for emergency one-side action. The VAPOFLASH principle is also available as a temperature probe to control fuel pressure directly in a turbine of turbo-propeller. This configuration is particularly advantageous when applied in a rocket jet gas turbine control. Get complete technical details and application data about VAPOFLASH in its three forms. We are confident that our long experience and extensive facilities for developing, manufacturing and testing jet engine related components can be of practical value to you. For full information and engineering control please address your inquiry to our headquarters: Manning, Maxwell & Moore, Inc.

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 Pines 8 825, Hook Manufacturing Co.,
 2481 Bellevue Ave., Detroit 7, Mich.

Finishing procedures and preparation and application of 17-4 PH and 17-7 PH stainless steels, booklet P O 4777, Product Information Service, Arvon Steel Corp., Middletown, Ohio
 Characteristics, application data and specifications of porous sintered stainless steel filter, Catalog 54101, The Crane Engineering Corp., Mendota, Ohio.

Description and diagrams of patented self locking, scaling and shifting principle of Nylon-Dacron threaded parts, circular Nylon-Dacron Corp., 100 N. Woodland Ave., Garrettsville, Mich.
 Machine Tool Controls data log for all types of machine tool users in aircraft, rocket production, etc., True-Trac Sales Corp., 9510 East Park St., El Monte 91, Calif.

Professor characteristics of re-designed, re-engineered and re-calibrated IEC fixed magnification meters, Technical Data Bulletin 3-1C, International Resistance Co., 401 North Broad St., Philadelphia 5, Pa.
 Color brochure describes Hi-Torque Belt configuration, Hi-Shear Blast Tool Co., 2809 West 247th St., Torrance, Calif.

Residual Stresses in Cold Finished Steel Bars and Their Effect on Manufacturing Parts, pocket-size book, La Salle Steel Co., Illinois, Ltd., Argyle, Ill.
 Application data on Brown Pin Steel River, catalog, Deutsch Industrie Corp., Dept. 16, P.O. Box 61875, Los Angeles 63, Calif.
 Illustrated description of stacked metal-polymer variable capacitors, Bulletin 9C-173, Sylvania Corporation, Toledo 2, Ohio.



Stacked Ceramic Tube
 Stacked ceramic tube bears power surge for tube, Type SN-2466, capable of delivering 44 watts under class A modulation at temperatures up to 300°C, a new variable in pilot quantities. Developed by Sylvania under Navy Bureau of Ship sponsorship, stacked ceramic tube also is available in Type SN-1794G, a high Q_u resonant metal-polymer, and SN-2274, a high power dual mode. Sylvania Radio Tube Division, Emporium, Penna.

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For more information on any of the above or other related fields, contact Arthur J. Glass, P.O. Box 97A, Raytheon Maynard Laboratory, Maynard, Mass.

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Armco PH 15-7 Mo is a new stainless steel specifically developed to meet the need for special stainless that will withstand the stress and heat imposed on high-speed airplanes. It is a progressively heat-treating stainless similar to Armco 17-7 PH, a grade that is used extensively in the aircraft and space aircraft and missiles.

Meets Industry-Specified Requirements

These are some requirements for aircraft metals stipulated by aircraft manufacturers. Higher mechanical properties at stress and elevated temperatures, good fabricating characteristics, weldability in the forms and thicknesses needed, and good corrosion resistance.

All are met by Armco PH 15-7 Mo. It offers the best combination of characteristics for airplanes that must operate up to 1000 F, including those designs requiring thin sheet and coil.

Typical Tensile Properties of Armco PH 15-7 Mo Steels Condition PH 500

| | 16 F | 800 F | 810 F | 1010 F |
|--------------------------|---------|---------|---------|---------|
| Tensile strength, psi | 240,000 | 204,000 | 210,000 | 125,000 |
| 0.2% yield strength, psi | 215,000 | 175,000 | 180,000 | 100,000 |
| Elongation % in 2" | 6 | 6 | 8 | 18 |
| Impact, foot-pounds | 54 | — | — | — |

Excellent Workability, Simple Heat Treatment

Armco PH 15-7 Mo can be fabricated readily by standard aircraft production methods. It is easily drawn or formed in the annealed condition, then hardened by simple, relatively low-temperature short-time heat treatment. In fact, fabrication methods and heat treatment for PH 15-7 Mo are identical to those for 17-7 PH stainless. Most aircraft manufacturers and their subcontractors already have production experience that can be applied to this new high-strength metal.

Additional Data Available

Get complete information on this special Armco Stainless Steel. See how it can be used to design for greater resistance to supercruise stresses and heat. A folder listing forms and elevated-temperature properties, available sizes and thicknesses, as well as information on heat treatment and fabrication is yours for the asking. Just mail the coupon.

New Armco PH 15-7 Mo Stainless Steel provides an outstanding combination of advantages for the design of supercruise missiles and aircraft:

- ... Guaranteed minimum ultimate tensile strength of 225,000 psi at 70 F (sheet, strip, wire, pipe, wire rope)
- ... Available in all forms—this page strip (coil), strip, sheet, plate, bar, wire, and billets
- ... Exceptionally high strength-weight ratios
- ... Better creep strength from 600 to 1000 F than any other metal sheet or foil
- ... Excellent short-time tensile properties up to 1000 F
- ... Most easily fabricated high strength aircraft steel
- ... Simple heat treatment procedures, distribution, fabrication practices
- ... Good corrosion resistance

ARMCO STEEL CORPORATION
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Company

Street

City State

ARMCO STEEL CORPORATION

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Sheffield Steel Division • Armco Drainage & Metal Products, Inc. • The Armco International Corporation



Navy Contracts

Washington—Following is a list of unclassified contracts for \$25,000 and over as placed by Navy contracting offices:

NAVAL AIR MATERIAL CENTER, Naval Air Station, Philadelphia, Pa.

Atom-Fission Products for Testing Data—Contract AF33-619-A-253-3. The 12 associated subcontracts for OVA-22 associated contract AF33-619-A-253-3. 12 associated subcontracts cover energy storage systems. OVA-22-1. 12 associated subcontracts cover energy storage systems. OVA-22-1. 12 associated subcontracts cover energy storage systems. OVA-22-1.

Airside Line-Removal—Frog. Within base field renovation and to be equal to 600 square feet. Estimated \$124,500. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

General Use Light—The Submarine Attack, rapidly assembly and emergency assembly. Estimated \$100,000.00. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

NAVAL AIR STATION, Florence, S.C.
Removal and Repair of—Removal and repair of a structure. Estimated \$124,500.00. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

ROBERTS PEBBLE MOUND OFFICE
Facilities—Naval District Navy No. 224. First Floor. Estimated \$50,000.00. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

Two Street—Contract AF33-619-A-253-3. 12 associated subcontracts cover energy storage systems. OVA-22-1. 12 associated subcontracts cover energy storage systems. OVA-22-1.

REPAIRS TO FIBER OPTIC WIRE
 Estimated \$25,000.00. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

REPAIR OF AIRCRAFT
 Estimated \$25,000.00. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

REPAIR OF AIRCRAFT
 Estimated \$25,000.00. Delivery: 1972. H. H. Construction Corp., 1000 N. 10th St., Philadelphia, Pa. 19102. (215) 382-1100.

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MAINTENANCE CLEANING:

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- 1 "Planes absolutely clean, free of oil, grime and dirt after washing with Oakite Composite No. 7L."
- 2 "Engine parts perfectly stripped of all deposits, including paint, with Oaktite Sation."

3 To remove a major fuel service nozzle "The streaking of welds on aluminum... less of 6 weeks' time." It's an oil mist that's destroyed, in water wash waste sprayed on, let soak a while, and add waste water.

4 "Results absolutely amazing cleaning ramps and aprons with Oaktite Composite No. 7L."

5 "Oaktite Remover a 100% success for spot cleaning or 'dry' washing of planes."

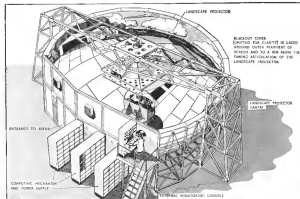
6 "Oaktite Remover a 100% success for spot cleaning or 'dry' washing of planes." repeats a heading sentence in N.Y. area. "Calls comes up tonight as painted metal needs, don't waste really planes." The solvent is fast, easy, safe, dilute with water. No real economy.

7 "Results absolutely amazing cleaning ramps and aprons with Oaktite Composite No. 7L." leading sentence in L.A. area speaks solvent over engine parts by truck, less a week for hot lava, then wash. The washing, 100 lbs. now done job where 500 lbs. of solvent material were needed.

Direct Division Sales America, Oaktite



Published Service Newsweeklines in P. 2 and Oaktite



LANDSCAPE PRESENTATION provided by ten Steel Brothers lat-cutter simulator is designed to provide realism in all phases of pilot training including instrument work. Complete ground action of two properties to combine with all features of the aircraft.

British Developing Helicopter Simulator

A helicopter simulator, designed to provide low-cost pilot training in primary and advanced phases, operational systems, emergency procedures and instrument work, is in advanced development by Research Department of Short Brothers & Harland, Ltd., Belfast.

Equipment is suitable also for research into helicopters covered and its light problem. It has designed to ultimately simulate a range of aircraft and turbine rotary wing aircraft, using a connecting rotor capable of producing the necessary data.

Present computer for training is an analog type fed with electrical input signals derived from potentiometers connected to excite and collective pitch controls, rotor bar and thrust controls.

Outputs simulating aircraft attitude, rates and translation are fed to a projector which projects suitable terrain panoramas and cabin views and the selected instruments.

Other competing loops provide the effects of an timely and precise with altitude development of induced flow



THREE DIMENSIONAL LANDSCAPE can be "flown" by turbine rotor bar or night conditions, as well as varying conditions in its flight or descent. Future reasons of simulation will permit training pilots in various modes of control and future rotary wing aircraft.

Long Range Planning and Research at Marquardt...



By
Roy E. Marquardt
President

Although concept development in the Aerospace Division is the major activity here at Marquardt, there are three other divisions carrying on significant work. Control and Guidance, Test, and Long Range Planning and Research.

The principal of these Divisions is Long Range Planning and Research, headed by John Driscoll and employing 80 engineers. The Division has two primary functions.

PLANNING—anticipating product trends to areas where we saw gaps or slight excess. Actually this planning is done in a staff capacity, and normally the results end up as recommendations.

SUPPORT—to the other divisions, by expediting product improvements which offer promise for the future. These improvements generally involve a small scale program to establish the idea as feasible. This research function also may be concerned with areas which do not fit into present Marquardt projects.

Long Range Planning and Research was begun in 1964. One of its first studies concerned areas where the concept was new to us or where it might be used in the foreseeable future. It deals some exciting new aircraft cycles have been planned. Some are variations of cycles now in existence, others are totally different.

Projects also have probed new "control" fuels, new types of heaters, auxiliary systems, and methods. One phase of Aircraft Nuclear Propulsion is now being explored.

Great work has been done. Northridge, California recently for a research test center. This aerodynamic facility will have testing capabilities by March 14 as a wind tunnel and March 20 for free jet testing with constant simulation of jet engine cycle conditions (Krytoxite Number). In addition, it will permit simulation of engine cycle conditions in Mach 8 and altitudes above 250,000 feet.

Within the Division, research engineers will find situations of research engineering opportunities, including:

- Design
 - Analysis
 - Development
 - Test
 - Operations
 - Production
- For information about these positions and the professional engineering requirements at Marquardt, we invite you to write Jim Clark, Professional Personnel, today.

Roy E. Marquardt



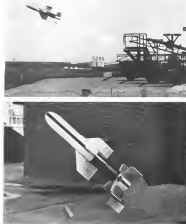
To Research Engineers Face the ENGINEER BARRIER*



Marquardt Means Opportunity—Research engineers have a veritable spectrum of projects at Marquardt Aircraft, the company where an "ENGINEER BARRIER" has never existed. Here is an engineering environment, you will work with a management that recognizes and rewards the contributions of engineers. Look to your future by looking to Marquardt, today. Address your inquiries to Jim Clark, Professional Personnel, 19521 Sepulch St., Van Nuys, Calif.



Mark Eric, John Dehn, Director of Long Range Planning and Research Division



Shot Reveals Multi-Purpose Missile

Series-logic test vehicle developed by Short Brothers & Harland is shown at test firing (top photo). Photo at bottom shows the multi-purpose vehicle as it was exhibited for the first time at Farnborough this year. In appearance at the air show was the first indication that Short Brothers was working on the project. The missile bears a resemblance to the French SA-10 anti-air missile, the French Meteor CV test vehicle and the U.S. Aerospace Dart.

In various stages of rotor operation—from the slowest to best, through intermediate to the propeller working state—and the substance on that of forward flight and ground pressure. Near governing controls, maintained in engine and rotor speed competing stress, withstand noise and vibration of these components—like a rough sea gull—can be completed into the secondary blocks of the system as required by the astronaut, who can also vary its level of death.

Short Brothers enables the pilot to experience many of the actual physical situations as well, never on the seat of the cockpit mounting permit the fuselage path and bank attitude to be controlled in response to his

controls, except for very steep banked turn. Fusion is essential is required. Young conditions are not applied to the rotor, but change in handling is accomplished by twisting a color usage projected on a curved screen surrounding the cabin. Large gages plot a sensation of a three-dimensional landscape or scenario stretching to horizon. Image can be varied to include both day and night conditions.

The projected landscape permits visual reference type "flight" within an area of 150-ft diameter and up to 800 ft height, top mode of training an astronaut. Highlights to the coding of a particular type helicopter can be simulated with appropriate instrument reading and control response.

*ENGINEER BARRIER—an achievement level beyond which you cannot advance.

when **HEAT**
can cripple your component . . .

you need a Thermoflex-insulated housing
by Johns-Manville



Typical insulated housing designed by Johns-Manville for wind tunnel component.

In the *living furnace* that is today's jet aircraft—or missile—components must still deliver maximum performance. That's why so many manufacturers of actuators, starters, pumps and electrical equipment are turning to insulated housings as developed by Johns-Manville. These housings are tailor-made for each component design. They fit snugly and form a continuous barrier against the scorching temperatures encountered at supersonic speeds.

Carefully fabricated of high-heat-

resistant alloys, Johns-Manville housings are insulated with ThermoFlex® refractory fiber felt. They are light in weight yet possess unusual structural strength and rigidity.

If your component is subject to failure from high temperatures, get in touch with Johns-Manville. Experienced insulation engineers will plan a housing to give your component the protection it needs.

Write to Johns-Manville, Box 14, New York 16, New York. In Canada, Fort Croft, Ontario.



Johns-Manville PRODUCTS FOR THE AIRCRAFT INDUSTRY

Certificates of Necessity

Washington—Office of Defense Mobilization has authorized certificates of necessity for accelerated manufacturing totaling \$17,847,977 for production of liquid oxygen and liquid nitrogen. A total of 50% of the estimated cost of first portion of each facility needed for the military production of the two materials is eligible for rapid tax amortization.

Largest contract, \$4,008,544, was awarded to The New England Industries Inc., Fort Pierre, Pa. Other certificates awarded for the production of liquid oxygen and liquid nitrogen are: Louisiana Air Products Co., Portland, Ore. \$1,443,000; Big Three Welding Industries Co., Houston, Tex. \$1,100,000; The Oxygen Co., Phoenix, Ariz. \$1,010,000; Air Reductions Inc., Houston \$742,250; Big Three Welding Supply Co., Stuart, Fla. \$675,000; The American Oxygen Co. of Cleveland Inc., Los Altos, Calif. \$455,000; Pure Air Products Co., Asperger, Ga. \$115,000; Morse Oxygen Co., Reno, Nev. \$85,225; North Oxygen Co., Inc., Houston, Tex. \$11,244; The Ethanol Carbonic Corp., Ontario, Ohio \$1,050,000; Southern Oxygen Co., Greenville, N. C. \$100,000; Celanese Oxygen Co., Sacramento, Calif. \$115,000; California Oxygen Co., of Los Angeles, La Brea, Calif. \$124,000; Air Reduction Co. Inc., South Action, Tenn. \$2,842,250; The Allied Carbonic Corp., 514 Princeton, Calif. \$400,000.

W. Germans Activate Air Transport Unit

Bonn—German Air Force has activated first squadron of its transport command.

New squadron consists of 16 of 28 Douglas C-47 Deltas, recently purchased by the Defense Ministry. Full strength of the 61st Transport Wing to which new squadron is attached is fixed at 125 planes, chiefly 4-engine heavy Nord 201 Nordlins.

Deltas are strictly stop-gap equipment in GAF inventory. Twenty-five Nordlins are on order from the French, 11 of which have been delivered to Mannheim for pilot training.

A German Defense Ministry spokesman said replacement of the Deltas with the Nordlin is scheduled to start soon.

Luftwaffe production in Germany of the Nordlin is not expected to begin before the end of year. Defense Ministry has ordered 112 Nordlins from Flugzeugbau Nord, one of five production groups set up in West Germany following the ban of GAF.

Luftwaffe contract is valued at more than \$22-million.

for ordnance equipment
jet engines, aircraft, missiles

Edgewater rings

save critical materials . . .

reduce costly machining . . .

meet highest quality standards

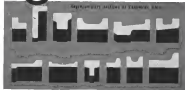
Your most exact specifications can be met by Edgewater Steel Rings—welded or seamless as required by the service. Formed accurately by modern methods, they are close to finish size as rolled. Weldless rings are rolled from solid steel blocks, in diameters from 5 to 145 inches. Welded rings up to 48 inches in diameter are formed from heavy bars extruded or rolled to shape. Both types can be made in a great variety of sizes and cross-section shapes, as shown below. Being accurate in size and cross-section, Edgewater Rings have costly material and machining waste.



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STANDARDIZATION DIVISION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS





ENGINE INLET location on Jetstar gives good run recovery at all attack angles because wing sets in flow straightening zone.

Lockheed Hopes Early Prototype Will

By Russell Hawkes

Bohach, Calif.—Lockheed CL-329 Jetstar, first light aircraft yet designed to fly, will be built at the company's Merced, Cal., plant if and when enough orders are received to justify production.

It was named from a sketch put to first flight in 261 days by a blue ribbon team of 43 engineers (prototype cost within three pounds of projected weight) and 310 technicians and administrators in response to a letter a year ago to 25 manufacturers from Maj. Gen. Donald H. Baker, then Director of Procurement and Production for Air Material Command. The letter asked a USAF requirement for such an airplane to be

gratefully financed in a replacement for E-25, C-47 and C-41 aircraft now being used to haul high priority personnel and cargo and passengers. It is ordered on the civilian executive transport market (AW Feb. 13, p. 32).

Market Hopes

Lockheed hopes to get the USAF contract and show the ease of the civilian business transport market by being first on the scene with a production airplane also based on complete prototype testing. Company officials also express hope that their aircraft may lead an order from the Navy. C. L. Kelly, Johnson, Lockheed Vice President of Engineering and Research and head of the CL-329 design team, says

the structure of the airplane is such that it could easily be modified for deck landings and rough runways. Stall speed is only 73 kt. About the same as that of the last generation of propeller-driven center fighters. Best cruise speed is 440 kt. at 40,000-45,000 ft. Speeds are limited above 35,000 ft. to Mach .76 for climb, Mach .51 cruise and Mach .43 desc.

The production airplane will probably be powered by five General Electric J85 turbojets mounted in two engine pods at the sides of the aft fuselage. The J85 produces 2,500 lb. thrust from a dry weight of 295 lb. and is designed for conversion conversion. An other possible powerplant is the Pratt & Whitney J44, designed to meet USAF



FIRST PROTOTYPE OF CL-329 is powered by two Bristol Olympus 17F turbojets. Production plane will use five GE J85s.



TEST PILOTS report extension of Jetstar's stall speed limits causes little change in trim.

Stimulate Jetstar Orders

specification. Close between two now depend on availability which a problem existed on both cases but no order has been placed for the J85. Lockheed hopes to have the J85 on the second CL-329 prototype which will be next summer.

First prototype is now being at Edwards AFB with two Bristol Olympus 17F turbojets. It is possible that a production configuration of the 329 might use a pair of Wright 7237 engines, increasing weight by 400 lb. The 7237 is a heavy inlet advanced version of the Olympus, equivalent to Bristol's Olympus 13, developing 4,850 lb. air level maximum thrust with a dry weight of 370 lb. A downsizing of the 17F model for the Lockheed application in the absence of auxiliary, direct

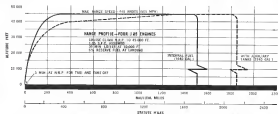
In the first prototype, engine systems must be powered by a ram air turbine with its inlet on the leading edge of the engine pod strut in the middle of the low energy boundary layer along the leading edge.

Second Prototype

Must be now, being out here for the second prototype. The surface is expected to be complete by January. Third flight will be delayed till sensor swathing delivery of J85 engines. Design of the second airplane will permit use of the JT7 of the smaller engine area if ready for Johnson's needs for going ahead on the second instance to give a reserve of engine availability to fly CL-329 again and extract from the four



FOUR-ENGINE configuration of Jetstar.



RANGE PROFILE shows design capabilities of production Lockheed CL-329 equipped with four General Electric J85 turbojets.

Lockheed CL-329 Jetstar

BASIC DATA

| | |
|---|---------------|
| Length | 59 ft. 10 in. |
| Height | 20 ft. 6 in. |
| Wing Overall | 37 ft. 0 in. |
| Outside Fuselage Diameter | 37 in. |
| Aisle Width | 75.75 in. |
| Wing Area | 55 ft. 0 in. |
| Wing Area | 515 sq. ft. |
| Aspect Ratio | 5.1 |
| Loading Edge Sweep | 34 deg. |
| Horizontal Tail Span | 24 ft. 0 in. |
| Horizontal Tail Area | 149 sq. ft. |
| Vertical Tail Height (Above Cabin Exit) | 14 ft. |
| Nominal Takeoff Weight | 28,000 lb. |
| Maximum Takeoff Weight | 32,400 lb. |
| Loading Weight | 21,000 lb. |
| Thrust Ratio (Takeoff Weight to Military Power) | 1.85 |

of Lockheed's experimental prototype used to make room for later work without necessitating a second test air.

Wings of the CL-329 are swept aft 34 deg. at the leading edge and have a dihedral to chord ratio of 15% at the root and 9% at the tip. A mild concave convex cuts surface comes and drives top and tail allowing good high speed performance.

Wing Structure

Wing structure consists of ribs, extended data with integral T-section stiffening, some of which is aluminum alloy, and the conventional laminate skin now spar with integral fuel storage space inside. Wing box is not carried through the fuselage. Wing loading loads are picked up by five heavy cross-sectional fuselage stringers through a lower root rib to which the tank spar is pinned. Limit load factor is 3.5, 40% higher than required by Civil Aviation Administration regulations. CAR for transport category aircraft.

Johnson tells that an epic of the five keeled jet rigs, about 270 lb. in weight, is used from the main cabin through structure. About 11 to 18 inches of leadwood are used in the forward end of the cabin with five stringers. Addition of 300-gal dapper tanks halfway out along each wing to the 1,840-gal in the tail extends range to 1,850 nautical mi. Skipper tanks feed into the external tanks automatically as fuel is consumed. Mexican pop loaf and half pepper tanks can be carried without exceeding the maximum take-off gross weight of 32,400 lb.

In the military application the CL-329 will be able to land at virtually maximum take-off weight. For civilian use, landing weight is 20,000 lb. Fuel

can be fed off through dump valves at the wingtip trailing edges to get weight within loading limits in the event of an aborted flight. The engine is air fedded from the ground through filters on each wing at 250 gal per minute.

Fuel lines from the tank open pass through the wing root filter, into the fuselage aft section and out through the engine fuel struts with out entering the pressurized area or protruding outside the fuselage left line. All fuel lines are aluminum or stainless steel and the drains are vented to the outside atmosphere. There is combustion tank level between right and left fuel storage areas.

Location of the engine seats above and about 125% of root chord forward

of the wing trailing edge results in good nose recovery at all angles of attack, because the wing serves as a flow straightener with the air entering at an 11-deg angle of attack, angularity of fins at the inlet is only two or three degrees. Wing also prevents rotation of foreign objects during ground operation. Location of the engines naturally improves flow over the wing but deliberate blockage by air drag inlet flow rate has been discussed as a means of ensuring that engine exhaust stays ahead of tips. Position of engine aft of the pressure backflow means lower level and danger of cabin pressurization is factored into generator or turbine blades.

Jetstar has 60% open boundary layer control flaps. Low energy boundary layer above the wing trailing edge is managed by extending engine bleed air to the upper surface of the flap. Bleed air is ducted through the flap stiff and ejected aft through orifices in the flap upper leading edge. Since the flap hinge moves aft as the flap is extended, a constant chord flap joint which Johnson calls a "boundary fitting" is required. Boundary layer control is expected to knock 7-10 kt from the stall speed of the B55 powered airplane. It is much less effective on the tank prototype because of the low compression ratio of the Olympus engine. Full span automatic leading edge slats on another aircraft from stall speed to get it down to 75 kt.

Variable Tail

Roller control of the CL-329 is also downwash located. A novel pitch trim device uses stabilizer incidence by changing the angle of the control fin to which the stabilizer is rigidly attached. Angular motion of fin and stabilizer covers nine degrees (from

plus 2 deg to -7 deg). High speed trim settings also provide more fin sweep. Fin and stabilizer are adjusted by the electric power control system actuator in the fuselage tail section acting upon the root of the forward fin. Hinge point is at the root of the aft fin spar. Fin leading edge moves relative to the fuselage structure at that point.

Johnson says this means of moving pitch trim is better than the more usual method of turning stabilizer incidence while the fin remains fixed. Hinge and actuator loads can be picked up at the lower spar root rather than in the concentrated area and lighter structure can be used.

Test pilots report that extension of the control speed brake causes little change in trim. The brake is ported and aft hinge means air on a track so it is intended to exert a nearly pure drag force for all in the context of gravity.

Cockpit Layout

Cockpit layout is standard with air-gage switches and radio controls centralized in the control pedestal. Two pilots are preferred for ordinary operation but it is possible for the captain to be flown by one man at altitudes. All instruments and controls except the control levers are within reach of the left seat. A secondary steering wheel is installed to the pilot's left, but the plane can be steered on the ground with linkages if necessary.

Both pilot and copilot have Collins Model integrated flight instruments. An engine ground test switch enables driver to check all engine circuits in one operation. A failure at any point before a jet starting light when the switch is depressed to show that a more detailed detailed shooting procedure is required. An automatic check list is mounted on the instrument panel and individual points on the list are illuminated from behind the panel when a system is inoperative. And jet test pressure limits exceeded, critical fuel panel, etc.

In a complete hydraulic system, the landing gear is controlled by a master valve at the wheel which opens the gates and the air baffle compartment and extended by gravity. The forward attaching nosewheel is steered by a toggle at the cockpit rafter and extended by gravity and drag.

The 500-hp plus plus CL-329 is almost light enough to be termed a DC-11 replacement. In its standard passenger version, it will carry 10 passengers in comfort and will burn 100 gal an hour. Load of 3800, 100 lb engine and 100 lb passenger. The USAF's conventional procedure engine version with proper main seating will carry 15 passengers and will fuel range at a rate of 614 mi./hour.

over a 1,380 nautical mile range. Payload is 4,000 lb and cargo volume is 736 cu ft in the passenger version. The center aisle floor is about six inches lower than the floor under the seats, giving 5 to 6 1/2 in. of headroom. Wings converted to cargo, a panel is bolted over the seats to provide a level cargo floor cleared for 16 G deceleration. Absolutes of half the cargo or baggage space, the galleys and spacious lavatories, all should make it possible to add an extra seat to the configuration. The standard galley has a heating oven with a 12 liter capacity and a coffee maker. A more sophisticated version has far more and still convertible into berths for

Crash Resistance

The first prototype has the standard passenger interior with 30 angle seats

arranged with five on each side of the aisle and a longitudinal spacing of 40 in. on center. The seats in the passenger area are stowed for only 9 G, but the seats in later surplus will be stowed for 16 G to take advantage of the crash resistance inherent in the lighter structure. Two heavy fabric fuel tanks should make for safe belly landings. Absolutes of half the cargo or baggage space, the galleys and spacious lavatories, all should make it possible to add an extra seat to the configuration. The standard galley has a heating oven with a 12 liter capacity and a coffee maker. A more sophisticated version has far more and still convertible into berths for



Why Should An Inspector Do This?

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it takes an Inspector, equipped with the best of precision gauges to select the pins that fit exactly. These precision keep pins and the master rod together, protecting the pins until they reach final assembly. This is just one more Airwork procedure that helps produce a longer lasting trouble-free engine.

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CLEVELAND



First Production Comanche Goes Aloft

First production model of new four-place Pipa Comanche helicopter plane is shown after the climb over Lake Harris, Pa., where the plane is manufactured. Pipa has set a production target of one Comanche per day in January, with expected output of five daily production. Powered by a 586 hp Lycoming, the Comanche seats at 160 mph at 7400 power and has a range of about 900 mi. at that speed. At economical cruise power, the plane has an endurance of 7.5 hr. or 1,100 mi.



NEW QUAKER HOSE

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additional jacket prolongs service life

From upstream to downstream end, the tested-and-proven Quaker hose holds the heat. In fact, temperatures of more than 400 F. to 450 F. hold no terror for this composite.

Neither does pressure. This hose has delivered 100 lb. per sq. inch of 425 F. air for 500 hours at 60 psi pressures. The schedule called for those hours an operation and one hour off.

This light and flexible hose comprises two elastic rubber layers covered by a synthetic fiber jacket. An extra outer jacket of corrugated rubber protects it against wear and abrasion. Lengths are continuous up to 50'. Couplings can be regular expansion and shrink hose.

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H. K. Porter Company, Inc., Philadelphia 24, Pa.

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QUAKER RUBBER DIVISION

in with a streambed and more for per foot deep four-pass passages on a sidewall being longer.

There are two air evacuation configurations to easy letter patterns and walking crutches as well as four air tanks. A glided entrance for large flights has eight seats, a lounge berth and a berth for a third crew member replacing the air tankcase of the standard configuration. Location of the global structure is forward, behind the engine in space used for common baggage in the standard version.

Passenger entry is forward on the left side. Entry stairs fold inside the door as necessary. A double-hinged plug door is used to prevent accidental opening when pressurized.

Cabin Pressure

Cabin is pressurized to a cabin altitude of 5,000 feet at an outside pressure altitude of 45,000 feet. Cabin pressure controller is a shrouded item manufactured by Adair Research. Cabin structure is the same for use as a stopper design and is bigger pit than ports to prevent local duct failure from expanding and distressing pressure area. Large structure by explosive decompression. In the rear the airplane is ready for production, extensive fatigue testing of all structures will have been completed. Assemblies are applied to each passenger and crew seat from a single system and provisions are installed for exchanging the crew work around berths from the pressure section.

A large volume, low velocity air conditioning system is used to eliminate drafts and whistling. The system has an active refrigeration. Mass ducts run along the sidewalls through the outboard area with the ceiling. A variable cold air jet and reading light are installed at each passenger seat and an overhead side light is between each pair of seats.

For coordinating along with all other airplane systems is driven by engine accessories. Each Operation of one engine will divert the air conditioning on the ground as well as vital hydraulic and electrical services. All system power units are located in a compartment just aft of the cabin pressure bulkhead and put behind of the engine pods. This maintains the distance that accessories power can be transmitted and supplies hydraulic accessories and pumps, electrical generators, air conditioning system, etc., at one convenient place for easy maintenance. Two baggage bins are in the same compartment.

There are two separate hydraulic systems, each with its own engine-driven variable volume pump and reservoir. Hydraulic-powered components are divided between the two systems but both drive the duplex aileron boost. Besides

and other vital components may operate all other system at the option of the pilot. If either system should be lost the other would provide adequate aileron boost. Conventional cable control handles the boost control. One system includes a battery or ground power drive electric pump for ground operation.

Escape Hatch

The speed brake does double duty as an entrance to the pressurized aft baggage and engine compartments. An unusual opening hatch is above the speed brake to prevent turbulence in the compartment when the brake is extended. In answer to a USAF desire for pre-charge escape provision, Lockheed has proposed an escape hatch through the pressurized aft compartment which could be entered through a hatch in the pressure dome and lift through the open hatch by extension of the speed brake.

Weather radio specified for the CL-52 will probably be the RCA APS 42 with a 24 in. dual antenna radio lighted equipment is made available. The electrical system draws its power from a 1,500-volt, 115-v., three-phase, 400-cycle

ac/dc inverter with a 250 v.a. standby inverter. Two 550 amp starter/generators supply d.c. power with two 12-v., 75 amp. hr. high rate discharge batteries in series connected to the bus for partial voltage stabilization and emergency power.

New Finance Plan Given Cessna Dealers

A new finance plan to allow dealers to purchase demonstrator aircraft at lower retail cost and an earlier pay-off is being offered by Cessna Aircraft Co.'s subsidiary National Aero Finance Co.

Under the new plan a dealer can purchase a \$10,000 Model 172, for example, for \$800 down and finance the balance over 24 months.

First month's payment would be \$249 and payments would decrease each succeeding month.

In addition to allowing the smaller dealerships to purchase additional demonstrators at lower cost, the plan also aims by company officials at enabling more operators to take on a Cessna dealership.

Small Plane Arrivals Set Record at Piper

Lock Haven, Pa.—More than 2,500 persons arrived here in more than 670 private and business airplanes recently to help Piper Aircraft Corp. celebrate the sale of its 45,000th airplane, a new-world record for private aircraft production.

It is believed to have been the largest number of airplanes to show up at one airport for a single-day event.

High density of arriving traffic made it impossible to provide individual landing instructions at most times when up to 15 airplanes in the traffic pattern simultaneously and landings were being made at the rate of eight planes a minute.

Departures were made in a stream about, with a dispatch on the runway signaling planes off at approximately 10-min. intervals. Not a single airplane was scratched during landing or take off.

A Piper PA-23 Apache light twin, serial No. 57,008, was presented to President W. T. Piper, Sr., in his private transport.



CONVENTIONAL CONFIGURATION seats 150 mph., four-place Model M-4 shown in flight test at right. Photo at left shows how two wide doors on right side, weather door on left, enter access to cabin area. Powerplant is 145 hp. Continental with Fiberglas cowling.



Aircraft Equipment Manufacturer Considers Lightplane Production

Jackson, Mich.—An established light aircraft equipment manufacturer here is studying the market potential for a new four-place single engine business plane which he estimates would cost about \$5,000 in production quantities.

If the Model Co. has been light testing a prototype Bic Dec. M-4 for over 100 hr. and reports that no adverse flight characteristics are noticeable.

Company look at the M-4 indicates that Model has increased liability from usual mid-continental lightplane design, the vertical tail,

long and wings 1,050 lb. empty.

Cabin features three door entry, one on each side, with additional door for rear seats on the right side. Floor is fitted with a 12 v. electrical system.

Construction is steel tube frame with wood framing stringer, wing covered with milled Fiberglas fabric and reinforced to silicon nitride, absorbing shock on rubber pad entry.

Rear construction is steel tube frame with wood framing stringer, wing is built up of aluminum alloy, fabric covered, with milled Fiberglas wing tip. Landing gear is of the tubular type using top of the main gear having individual compression groups which they join under the fuselage, a single shock absorbing system that the usual cylinder type; Model power out.

Powerplant is a 145 hp Continental engine enclosed in a Fiberglas cowling. Top speed is 170 mph. Cruise speed is 145 mph, cruise speed 150 mph. Landing speed, using manufacturer's selected flaps, is 45 mph. Range is given as 575 mi. with 30 gal.

The Bic Dec spans 10 ft., is 22 ft.

Aerial Sprayers, Dusters Crossed \$90-Million in Year, NATA Finds

Washington—U.S. spray/dust operations generated more than \$90 million in 1975 on a total investment of some \$75 million. National Aeronautics Techn. Assn. estimates on the basis of a recent survey of the industry.

The association's survey, covering about one in 15 applications in the country, including 50 of the most active agricultural states, provides valuable updating of statistics, reveals information in this aspect of business activities. Surveys were developed by Robert Menon, Peaslee, Ark., while he was president of the association's agricultural division.

Survey returns provide this picture of the average air application: he has a capital investment of \$48,300 and an income of \$58,498. Revenue being totaled 761 in last year and covered 5.2 months of operation. In this time he treated just over 57,000 acres, employing 5.2 people either part time or full time.

Average agricultural or application concern dispensed 95,700 gal. including conventional chemical and emulsified powder dust distributed averaged 367.5 lb.

Overall, spraying expenditures during 1974 ran with fuel being next in average cost.

More than half the replies to NATA's survey indicated that business was steady, or nearly all, concerned with aerial application. According to the replies, 85% of the key people in applying from the spray/dust area.

Paper usually topped the list in man-

ner of agricultural plants used, only 156 reported using an average plant. Fertilizer used an average of 4.2 aircraft in 1974.

As regards financial status, 43% of the application replies had a capital investment under \$20,000. At the same time was one company that reported an investment of \$700,000. A large number of firms stated that their investment ran from \$150,000 to \$200,000.

With reference to gross revenue, the larger gross averaged some \$35,800 with about 10% of the returns falling outside as the categories of \$10,000, \$25,000, \$45,000 and \$115,000. Revenues of up to \$200,000 gross were reported by 6%; two operators achieved over \$200,000.

As regards accidents, the replies indicated that spraying accounted for about five times the number of crashes. This must be judged in light of the fact that about four times as much acreage was sprayed as dusted.

Considerable opinion was expressed as to problems and needs by the spray/dust application.

• Shortage of trained agricultural pilots was reported by 58% of the replies, an even higher percentage stated a definite need for agricultural pilot schools.

• Need for a handbook to control wild birds on wheat and small grains was the single most mentioned item in the report. Also noted several times was a need for a selected gun folder to control these birds on wheat, a hand side for wild birds on wheat and

small grains, and a non-toxic chemical to fight the aphid on alfalfa and clover. To apply to the question "what single development do you think would do the most to extend your season or increase the market for your aircraft?" the replies could be summarized as follows:

- Chemical spray to effectively and economically lessen decomposition of store and stalk.
- A new method on short cycle, dry land cotton.
- A chlorinated hydrocarbon for alfalfa spot that would work in cooler weather.
- Filtered DDT.
- Good fungicide that could be sprayed from the air at low gallonage per acre for apples, peaches, strawberries and potatoes.
- Better chemicals to work on break during a longer period of the season against insects.
- A new (woodless) control in soy beans.
- Liquid spray control of plant diseases at low volume.
- A cheap carrier other than diesel oil with just a good spreading, penetrating and non-corrosive characteristics.
- More weight applications in a concentrated fertilizer that can be dispersed more efficiently from the air to enable small applicators to compete more effectively with ground application.

PRIVATE LINES

Goodview lighter than airship will be used by Chrysler Corp. in late summer early fall promotion schedule for new line. During daylight hours the airship will fly at 50 ft. banner at night two airships will be fueled in and off using 10-ft. high illuminated lettering. A total crew of 11 men are engaged to handle the airship aloft and on the ground during its tour.

Mooney Aircraft is expanding its Knoxville, Tenn., plant by spending \$100,000 on a structural-reinforcing permanent under a new, and plans already agreed a 30 ft. lease for this factor site.

Construction of World War II Whittier business to agricultural duties is planned by Commanco's Aircraft Corp., Melbourne, Australia, the original manufacturer. War-sponsored Whittier conversions are expected to sell for about \$20,000. Plans, increased Gross, will be fitted with a hopper

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Brazilian Lightplane Starts Tests

First flight of the Cessna W-140 shows four-place ultralight lightplane prior to start of the lightest pilot program recently. Spruced with a 125-hp engine is approximately 135 mph. Dual fuel is 1,200 lb. Fully loaded, it is designed to take off in 650 ft. It has a three-blade variable pitch propeller. Stage in Botucatu, Sao Paulo, Brazil, are being set up for production of the new lightplane.



computers

Northrop needs computing analysts, qualified either by experience or education, to work in their expanding Computer Center at Hawthorne, in Southern California. If you are qualified, there is an interesting position as well as a bright future for you at Northrop.

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If you qualify for any phase of computer research, design, or application, we invite you to contact the Manager of Engineering Industrial Relations, Northern Division, Northrop Aircraft, Inc., (Office 8-9113, Ext. 1895), or write to, 1041 East Broadway, Dept. 46004, Hawthorne, Calif.



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winging their own line of feather. Teedgie will be lengthened two ft. and wing area will be increased about 30%. Retractable landing will be fixed in the down position, wing flaps will be fixed at about 15 deg. down.

IRAN contract for Cessna T-50s operated by U. S. Army within Little Army area has been awarded Eric L. Heron Corp., Santa Ana, Calif. Work will be done at Tenzel Airport, recently leased by the service firm.

First three of an order of 15 AT-7 agricultural aircraft have been delivered by National Aircraft Corp., Burbank, to Crop Care, Inc. Total contract is for \$275,000.

Flexible wing fitted to a Taylorcraft BC120, designed to eliminate gust effects and used to reduce landing speed, has been granted CAA Supplemental Type Certificate SA-95. This item, under development since 1970, is built by "Wings With Springs" Manufacturing Co., Latrobe, Pa.

U. S. Navy ordered an additional number of Beech XKD81 turboprop-assisted target aircraft for flight evaluation at Naval Air Missile Test Center, Ft. Meigs, Calif. Follow-up contract is valued at about \$1 million and deliveries are scheduled to start in November. During recent tests, an XKD81 flew to 25,000 ft. and sustained altitude after catapult launching. Engine is a 120-hp supercharged McCulloch. Beech is forming Two Business near the northern hemisphere to meet the Air Assault, the key from General in South Seas being 1,000 sq. ft. over open water.

John G. Kelly, Inc., N. Y. is buying specially manufactured, approximately 10,000 General motor, a Model 177, after using it for 25 hr. on a test plan that readily had five years to run.

New facilities completed at Southern Illinois Airport (Hannibal-Markle) include runway extension which provides paved strip 4,100 x 100 ft. with additional 1,000 ft. overrun. Extension was made to accommodate larger vintage aircraft.

Rayco Service is a new production publication for airport base personnel being published by Single Selects Press. Intend to provide pilots with proper behavior and safe practices. Missing the wrong airport, landing, towing, taxiing, etc., are signals, proper holdover procedures, are among topics covered in first issue. Booklet on air inflated at cost 15,000 by SPY, 26 Fourth Ave., New York 16, N. Y.

WHO'S WHERE

(Continued from page 23)

Changes

Walter W. Potts, chief engineer, Titan jet fabrication, Inc., Burbank, Calif.
William E. Moran, general manager, Lytle Business Division, General Motors Corp., Harrison, N. J.
Milton J. Casara, executive vice president, Alcoa Aluminum operations, Alcoa Steel Plant Division of General Motors, Pitts., Mich.

Capt. Steven G. Brown, director of flight operations Atlanta, and Capt. Kyle E. Hawks, director of flight operations East (Atlanta), Trans World Airlines, Inc.
Alan E. J. Moore, TWA's general manager of passenger service, United States.
Samuel M. Bakstman, executive vice president traffic control, Government and Industrial Division, Philips Corp., Philadelphia, Pa.
Alan Lester E. Garbin, director of communications engineering.

E. J. Devcott, director of training and public relations, Vickers Inc., Detroit.
Abner H. Goetz, chief engineer, Polaris, Inc., Fort Worth, Tex., N. Y.

Murray C. Corbett, strategic product engineering, Avco Aerochemical Division, The E. I. du Pont de Nemours & Co., Newark, Ohio.

Arthur C. Reppert, production manager, Nucor Manufacturing Co., La Mesa, Calif.

Arthur Kuebel, director sales and service, Astronautical Division, Pacific Scientific Co., Los Angeles, Calif.

John J. Wink, industrial division technical director, Standard Process Steel Co., Jackson, Pa.

E. William Flinn, strategic metals sales, Lockheed Products Division, Lockheed & Weller, Inc., San Carlos, Calif.

Robert G. Scholten, manufacturing manager, Dayton Electric Co., Los Angeles, Calif. V. Fred Kauer, executive vice president, advertising manager.

Reg. Gen. James W. Andrew (USAF) will visit Northrop Aircraft, Inc. office in Hawthorne Springs, Calif. The office will be established to serve USAF's Gen. Howard Air Command headquarters.

William C. Stupp, assistant vice president, Charles Evans, division of Fiat & Wabco Company, Inc., West Hartford, Conn.

Richard E. DeLoren, general manager West Coast plant (Fowler, Calif.), Trent Tube Div., East Troy, Wis.

Dr. Glenn Mitchell has joined the engineering staff of Northrup Development Corp., subsidiary of Curtiss-Wright Corp., Santa Barbara, Calif.

Thomas F. Wynn, senior field engineer, Allison Corp., Los Angeles, Calif.

Herbert C. Ludvig, general manager, manufacturing, Avco Aerochemical Division, Trent Tube Co., Chicago, Ill.

Edward R. Carney, assistant group executive business operations, Defense Products Company, divisions, Marbuck & Foundry Co., New York, N. Y.

Shelton Matlock, executive administrator, Canadian Steel Division Corp., Montreal, Canada.

Robert H. Vandenbosch, manager-Titan operations, Marketing Division, Avco Aerochemical, Inc., Los Angeles, Calif.

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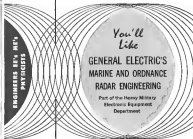
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LETTERS

Implication Corrected

Due to extended absence from office, Capt. Richard's Colonel Viewport at the top of page 10 of your excellent magazine was and brought to attention. I am glad that this is corrected as fact is correct as reported in the column but suggest you correct the implication in the column that Assistant Editor, the "errata" column. Manufacturers as well as others participate in the preparation of Air Force directives and when asked they are the usual way of order. If it is true that a manufacturer is entrusted to comply, with instructions would have to come from the individual active customer not Air Force. May we have your permission to reproduce the column for the subscribers of our "AEC" members?

WILLIAM T. CANNON JR., Chairman
Aircraft Electronic Engineering
Company
Associated Radio, Inc.
Washington D C

Pilot's Opinion

I am an active pilot and like to see other pilots who would like to pilot a jet. I believe that a defense budget is a crucial part of our economy and should be increased. I believe that a defense budget is a crucial part of our economy and should be increased. I believe that a defense budget is a crucial part of our economy and should be increased.

The ALPA is doing a job. I believe that a defense budget is a crucial part of our economy and should be increased. I believe that a defense budget is a crucial part of our economy and should be increased. I believe that a defense budget is a crucial part of our economy and should be increased.

As it may happen there are a few pilots who do not understand the responsibilities of a pilot. I believe that a defense budget is a crucial part of our economy and should be increased. I believe that a defense budget is a crucial part of our economy and should be increased.

Mr. Stanton is to be congratulated on his leadership in promoting the development of the Air Traffic Control Act (AWA) of 1970. We pilots must get along with our controllers and through their work produce a more efficient transport system. Pilot Spirit and other like him have improved their attitude to the public and through publicity they have helped toward the pilot group and thus, us. If the civil want to get along with other and being their attitudes one can ask a pilot they could not expect the backing of their fellow pilots.

I hope that others will accept the fact that the majority of the pilot are doing their job and are not doing anything to their passengers to their detriment in the future time and in a safe way. The pilot group must find a way of holding themselves

Account Work continues the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Executive, P.O. Box 230 W. 42 St., New York 36, N. Y. Try to keep letters under 300 words and give a precise identification. We will not print anonymous letters, but names of writers will be withheld on request.

of their life, who do so much to underwrite their occupation if the ALPA will do nothing. TW's Corvair

San Francisco, Calif

Defense Budget

Re Robert Hart's editorial in the Aug 25 issue entitled "Are We Really Saving Money?"—although I read Mr. Hart's column with great interest and wish I had responses to his comments about the defense budget and thus advise others upon our latest actions.

My entire working career has been spent in the engineering field associated with defense projects of one kind or another and though I believe that a defense budget is a crucial part of our economy and should be increased, I believe that a defense budget is a crucial part of our economy and should be increased.

The ALPA is doing a job. I believe that a defense budget is a crucial part of our economy and should be increased. I believe that a defense budget is a crucial part of our economy and should be increased.

At the point I wish that there if we could saving money, but it will be hard under some of the current action spending more money needed and hopefully result in a more efficient and controlled defense program.

Edward N. Y.

ICBM Awareness

Congratulations on your editorial "Early and Pictorial on the ICBM" in the Sept. 2 issue of *Aircraft Week*. Although the editorial comment is most enlightening, it still leaves me with questions. The problem being that the general public is not aware of the facts that you editorial and new comments of the May 20 issue of *Aircraft Week* are correct. Unless this is not over emphasize the general public is either confused or misinformed. The public in general would not see or

knowledge of the ICBM development in the following phrase: "We do not know for sure whether the Soviets have or have not as yet successfully fired an ICBM. We know that someone in the United States knows whether or not the United States has successfully fired an ICBM."

The lack of information contained in the above double talk plus the general negative attitude of the overall industry, leaves the public bewildered. A budget amount directive was quoted the other day as follows: "But knowing had to mean and it is time industry and the public found up to solutions. The public finds there is too much defense that an only national is market. The result lead some to believe that the aircraft industry still has accepted a policy of complacency. The result is not only a cutting of the long range technological planning and philosophy.

Technological development is not only concerned with the aircraft industry who have been preoccupied in making headlines due to cut backs in funds. Many industries are still within the aircraft industry field have not had cutbacks and have long range plans for development ensuring increasing numbers of scientists and engineers this year and for the years to come.

I hope that through your editorial you can address someone within our industry to fight the issue better and the best thing would be to take a position and highlighting the position that good scientists will be needed today and tomorrow and that more people should be encouraged to take engineering schools and to seek employment in stable industries, many of which are still in the service business.

R. L. Ayres
Shelton, Conn

Helicopter Errors

There are two errors in your presentation of one accident helicopter (AW Sept 2 p. 101).

Glenn mentions one in where one on the previous helicopter is a Kaman HO4E, actually it is a Kaman HHK.

Error number two, a rotor control error, is where you say the rotor is "controlled" by radio signals from ground through cables. The rotor is controlled by radio signals period. The rope (if it is not a cable) is attached to the rotor and to the ground system for safety purposes during the first pilotage flight. This one combined in one news release picture system.

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Charles Karamian
Vice President, Public Relations
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